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SWOT Analysis System of Vegetable and Fruit Industry and Texas A&M AgriLife Programs

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The analysis of internal and external forces affecting the performance of Vegetable and Fruit (V&F) programs in the Texas A&M AgriLife Agency and the Texas V&F industry is the first step for the development of a short- and long-term strategic planning. Our competitive Texas AgriLife (herein 'internal') agency strengths, weaknesses, opportunities and threats were formulated on the basis of a SWOT-analysis. Two knowledge-based regional workshops were conducted and a consolidated internal survey was developed for research and extension faculty engaged in V&F programs in the Agency.

The internal survey was a web-based survey and consisted of 13 questions, from which 4 were categorical (department affiliation, primary discipline, professorial rank and location of respondent); 3 were related to the level of activity on a scale of 1=none to 4=high (commodity, pre-harvest, post-harvest); 2 were related to top priorities rankings (number of times an area was ranked #1 or in the top 5), and 4 questions were related to the specific SWOT components on a scale 1=poor to 5=outstanding (strengths, weaknesses, opportunities and threats).

A total of n=87 participants clicked the link to take the internal survey, with participation declining as respondents progressed through the survey. This could be an indication that the survey was either too long, having complex questions or simply that respondents were not familiar with the programs. The number of participants who responded every single question was n=63. The number of respondent decreased from an initial high of n=79 (question #1) to n=63 (question #7). Considering that 39 participants participated in two regional informational workshops (Uvalde, Wintergarden and TAMU, College Station), the survey instrument was successful in identifying other personnel working in V&F programs.

The number of completed responses (n=63) was high, with an equal distribution of on- and off-campus faculty (n=31, n=32, respectively). The responses had also a good distribution of professorial ranks, with 41% professors, 25% associate professors, 17% assistant professors and 16% other. As expected, most respondents were from the Horticultural Sciences Department (27%), followed by Plant Pathology and Microbiology (21%), Entomology (14%), and Agricultural Economics (10%). Other Departments represented were ≤ 6%. The predominant discipline was production and crop physiology (18%), followed by entomology (15%) and plant pathology (14%). There was also a good representation of economics and marketing (9%), engineering (9%) and nutrition (8%). Below is a summary of the responses.

- **Level of programmatic activity**. There was a broad representation of programmatic activities by crops, reflecting the commodity diversity of Texas-grown products. Fruit products appeared with the highest level of activity with a mean value of 2.3/4.0. This may be to the fact that fruits were included in one single category and hence activity is represented for the aggregate level. In terms of pre- and post-harvest activities, responses were uniform and quite similar. For the pre-harvest

activity, the lowest mean values ranged from 1.27 for micro-propagation to a high of 2.13 for diagnosis and control of diseases. The highest level of post-harvest activity was plant disease-vector interactions and quality with mean values of 2.12 and 2.09, respectively. Overall, considering the range (1=none, 4=high), ranks were skewed to the low level of activity, which may indicate that: a) not many faculty are intensely focused in a particular pre- or post-harvest activity as opposed to be engaged in diverse activities and b) there is low number of faculty addressing multiple research and extension issues in V&F.

- **Top priority issues.** Respondents were asked to rank the top priority issue that needed additional resources for research and/or extension for AgriLife to increase its overall impact. Interestingly, and despite the diversity of respondents, the number one response was water use efficiency (n=16) followed distantly by IPM (n=7) and diagnosis and control of disease (n=5). When considering the top 5 priority issues, water use efficiency was still the top area appearing 31 times, followed by food safety (19 times), cropping systems (19 times), plant morphological and physiological adaptation mechanisms to environmental stress (18 times), diagnosis and control of disease (18 times), health benefits (16 times), and quality (15 times). There was high correlation between the primary discipline and the three most important priority areas selected. The predominant areas of work of respondents were production/crop physiology, entomology, and plant pathology, thus reflecting priority areas in those disciplines.

- **Strengths.** The major strengths of Texas AgriLife were cited to be *faculty and staff capabilities* (3.49) and *reputation and credibility* (3.48). Other cited strengths with a mean score of 3.0 or higher included: *dissemination of information to producers* (3.24), *effectiveness of addressing the needs of Texas based producers* (3.14), *extension and network presence* (3.14), *need for a center focusing on breeding and evaluation of new varieties* (3.13), *multidisciplinary research programs* (3.06), *effectiveness and resources for developing/breeding new varieties* (3.03), *effectiveness of screening and demonstration trials* (3.00).

- **Weaknesses**. The top weaknesses (level of impediment) of Texas AgriLife were related to *personnel*, *doing more with less people* (4.10). Other weaknesses that ranked high were *Institutional support* (3.84), *incentives/morale* (3.70), c*ommunication across disciplines* (3.60), and *disconnect between research and extension* (3.49).

- **Opportunities.** *New funding programs* (4.00) was noted as the highest potential impact category to benefit V&F programs across Texas AgriLife. The rest of the areas with potential impact for benefits ranged from 3.24 to 3.89. Those were: *specialty crops* (3.89), *locally produced fruits and vegetables* (3.70), *new alliances with stakeholder associations* (3.68), *flavor and quality* (3.65), *technology innovation to enhance programs* (3.57), *health benefits of fruits and vegetables* (3.52), *positive*

publicity of fruits and vegetables (3.52), *market AgriLife output to general public* (3.49), *sustainability and organics* (3.49), *science of breeding adaptable to other similar regions* (3.44), *education and outreach for kids and young adults* (3.32), and *international involvement* (3.24).

- **Threats.** The major threat of Texas AgriLife was r*eduction in budgets and personnel* (4.27). *Decreasing funding opportunities and more competition for funding* (4.10) was the second highest threat. Others with medium to high rating included: *attracting and retaining brain power* (3.87), *water availability* (3.87), *lack of knowledge/appreciation for agriculture* (3.75), *graduate student funding and support* (3.71), *the state of the US economy* (3.67), *climate and weather impacts* (3.67), *food safety* (3.65), *water quality* (3.49), and *industry fragmentation* (3.37).

External Analysis

- This part of the report summarizes the results of the V&F industry (herein 'external') survey conducted to assess the current state of industry in the State of Texas. A list of 200 growers, 75% conventional and 25% organic, were provided to the Public Policy Research Institute (PPRI), Texas A&M University. The survey with 18 questions was conducted via phone interviews by the PPRI.

- The survey provided data on specific crops grown, area per crop, and type of production (conventional and/or organic). Two questions were related to economics, including the value of the annual gross sales in 2011 and the marketing channels used by growers. The survey then concentrated on the *SWOT components* (strengths, weaknesses, opportunities and threats) with five questions and 54 subcategories. Each question was ranked from 1 (not important) to 5 (very important). Other data obtained from the survey included: familiarity of growers with Texas A&M AgriLife Research and Extension, technical assistance sources, programmatic values of research, extension and educational programs, future breeding, and growers support for programs. Finally, the survey gave *demographic information* of the respondents: age, gender and number of years in business. Additional information was included in open text boxes listed as "Other".

- A total of n=80 participants growing about 100,000 acres of fruits and vegetables responded the phone survey. Thus the survey instrument was successful in identifying an important segment of the V&F industry in Texas with a similar distribution of growers as initially provided (75% conventional, 25% organic).

- Respondents were 89% male, 11% female, with an average combined age of 51.2 years. This is interesting and represents a positive generational change, with farmers 7.7 years younger than the average Texas farmer of 58.9 years reported on the 2007 Texas Census of Agriculture. The average number of years firms have been in business was 31.6 years with an average gross sales value of $3.6 million. The preferred marketing channel for

66% of growers was retailer and broker/wholesaler, while packing house and processing accounted for 26%.

- There were a total of 36 commodities (32 vegetables and fruits, 4 row crops) grown in 98,000 acres, not including other minor crops grown in additional 1,900 acres. Major conventional crops (range 2,200 to 20,200) included potatoes, pecans, green beans, okra, onions, watermelon, cabbage, grapefruit, spinach, herb and spices. Major organic crops (range 66 to 475 acres) were grapefruit, green beans, oranges, carrots, spinach, and onions.

- The top strengths that contribute to the success of the V&F industry were *demand for US grown products* (4.19) and *geographical location of the State* (4.14), followed closely by *health and nutrition* (3.97) and *locally grown products* (3.9). Respondents *ranked government assistance programs* (2.58) as the least factor for their success.

- The top broad opportunity for achieving success of the V&F industry was identified by *Technology advances applied to agriculture* (4.09), followed closely by *applied longer term research* (3.93), *education and outreach* (3.72), *marketing and consumer oriented research* (3.67), and *applied short term research* (3.66). The lowest ranked opportunity was *federal government support* (2.82).

- Considering the type of long- and short-term research, technology advances and educational programs highlighted above, the top two specific **pre-harvest** areas that ranked very high (more than 50% of respondents) and that should be considered as priority for strategic planning are: *irrigation technologies* (4.45) and *water use efficiency* (4.43). Other general categories that also rank high were *pest and disease control management* and *diagnostics*, and *seed quality*. Medium ranked areas were: *transgenics, micro-climate modification* and *plant growth regulators*.

- The top four specific **post-harvest** areas that ranked very high to high were *product quality (taste and flavor)* (4.39), *food safety* (4.34), *health benefits and nutritive value* (4.03), *and improved product appearance* (4.01).

- The main external factor with greatest impact that hinders progress to the V&F industry is *water quality and availability* (4.77) followed by *cost of production* (4.37), *product prices* (4.17), *government regulation* (4.05), and *food safety* (4.03). Another factor considered high was *environmental stress* (3.83). Factors with the lowest impacts were *industry fragmentation* (2.97) and *bioterrorism* (2.59).

- The industry is highly familiar (90%) with programs at Texas A&M AgriLife Research and Extension where they seek help and support. However, the major source for technical assistance comes from *other producers* (76%), followed by *Texas A&M AgriLife and consultants* (69%). Other important sources of support come from *seed* and *chemical companies*.

- When respondents were asked to rate seven specific activities of the Agencies (5 for Extension and 2 for Research) the highest ranking was for *Dissemination of information to consumers* (4.03), followed closely by *Extension and network presence* (3.88), *effectiveness of addressing needs of Texas-based producers* (3.85), *advancement of technologies for producing quality fruits and vegetables* (3.79), *dissemination of information to consumers* (3.71), *education and outreach for kids and young adults* (3.71). In the medium rank was *effectiveness and resources for developing/breeding new varieties* (3.55). When respondents were asked specifically about *breeding new varieties*, the highest ranked crop was *onion* (17%), followed by *watermelon* (9%), *cabbage* and *spinach* (7%), *cantaloupe* (6%) and *tomato* (5%). Noteworthy, 48% of respondents believe that additional breeding should be done to new crops other than the ones they are currently producing.

- In terms of support, respondents were asked which of 25 programs/areas should be supported by growers and industry. The one considered as the top priority for funding support was *marketing programs (14%).* Other selections with 4%-5% of responses were: "*All areas*", *food safety*, *research and development*, and *breeding programs*.

- This external V&F industry survey, in conjunction with the internal AgriLife survey, was conducted as an instrument to develop a long-term strategic planning of the Texas A&M AgriLife Research programs on V&F in the state of Texas. Following the surveys we then discussed, analyzed, and integrated the combined data sets obtained from both surveys in order to determine critical needs and gaps of the V&F industry and resource capacity and programmatic gaps of the Texas A&M AgriLife Agencies. Below is a diagram of the SWOT process.

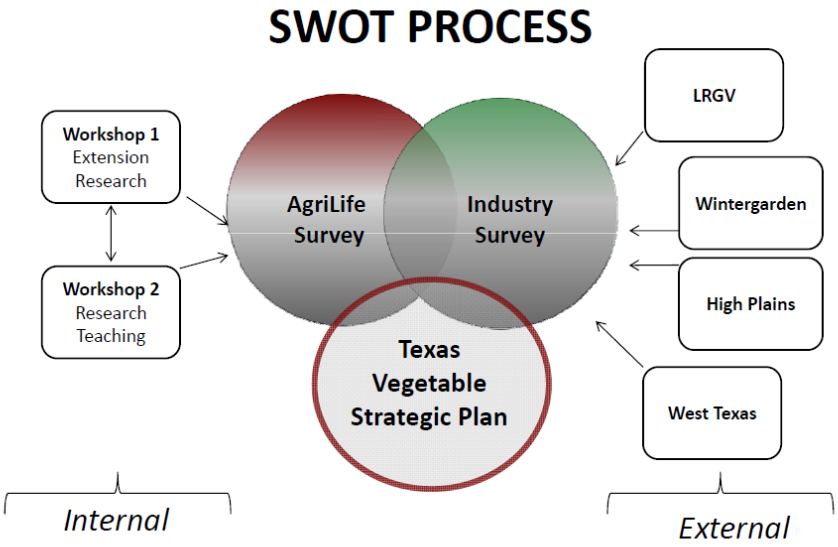

Figure 1. Diagram of the process for conducting the SWOT analysis

The Texas Industry

In Texas, the number of acres for fresh market and processed vegetables was estimated to be 73,700 acres with a value of $361 Million (NASS, USDA 2011) and an economic impact in excess of $450 Million. Crops in that estimate include cabbage, cantaloupe, carrots, chili peppers, cucumbers, honeydew melons, spring onions, summer onions, spinach, squash, sweet corn, tomatoes, watermelon and snap beans. Not included in that estimate are bell peppers, lettuce, broccoli, okra, other leafy greens (mustard, collard, turnip, kale, etc.), herbs, and potatoes.

From the regional focus workshops we have identified several economically important vegetable crops not included in the 2011 USDA statistics. Those are: 5,850 acres of specialty vegetables grown in the Wintergarden, Hill Country and Lower Rio Grande Valley (lettuce, tomato, beets, beet-tops, dandelion, parsley, cilantro, celery, Swiss Chard, collards, kale, kohlrabi, turnip greens, mustard greens, artichoke and habanero peppers) and 39,000 acres in the High Plains (30,000 dry beans, 7,000 southern peas, 2,000 pumpkin). Also not included in the USDA statistics are 14,040 acres of fresh market-processing potatoes (High Plains, Wintergarden and LRGV). Texas also grows 18,000 acres of grapefruit, 8,800 acres of oranges in the LRGV, 75,500 acres of improved pecan (3,000 in the Wintergarden and 12,500 in El Paso), 1,320 acres of peaches (Hill Country), 3,000 of grapes, and 35 acres of apples. Therefore the total combined area for growing vegetables, fruits, citrus, grapes and pecans was 238,745acres in 2011. The gross value of pecans represented $80 million in 2011.

Fruit and vegetable production is scattered across the state. However, the four major vegetable producing regions of Texas are the Rio Grande Valley, the San Antonio-Wintergarden corridor that includes the Laredo-Eagle Pass region, the High Plains, and West Texas. Other producing areas within the state include the Trans-Pecos, the Coastal Bend, East Texas and the North Texas area along the Red River. The leading vegetable producing counties in the State are: Hidalgo, Starr, Cameron, Deaf Smith, Frio, Uvalde, Zavala, Webb, Hale, Castro, Lamb, and Duval.

Historically, Texas ranked third in vegetable production behind California and Florida. Over the past decade, however, vegetable acreage has steadily declined to the point where Texas now ranks seventh in terms of volume (3% of the U.S. total). The acreage decline is attributed to serious problems with insects, diseases, and drought conditions during this period in the Lower Rio Grande Valley, the state's major vegetable production region. Competition from imported sources has also increased in the last 10 years. Currently the share of consumption derived from imports is 25% for vegetables, compared with 8.3% in 1980 and 15.0% in 2000. On the fruit side, about 26% of the fruit consumed in the US was imported in 1980. That number increased to 42.4% in 2000 and to 48.8% in 2010. Mexico and other Latin American countries are causing a closing of market windows previously dominated by Texas. With respect to consumption, it is important to emphasize the new dietary guidelines established in 2010 with “My Plate” which involves half of the plate with

fruits and vegetables. Therefore, the development of a strategic plan should address these trends in production factors, environmental limitations, marketing and nutritional health benefits of vegetable and fruits.

Previous Case Study of the Texas Vegetable Industry

During 1997-2000 the Texas Vegetable Industry was involved in strategic planning initiatives to address issues affecting the industry in South Texas and to develop specific strategies and implementation plans to resolve critical problems facing that industry (Hall and Lyford, 2001). This 3-year plan involved personnel and funding support from the Texas Vegetable Association (TVA), Texas A&M University (TAMU), Texas Agricultural Extension Service (TAEX) and Texas Agricultural Experiment Station (TAES). It also involved other agencies and groups such as TDA, USDA-ARS, TNRCC, Texas Department of Transportation and the TAMU Vegetable Improvement Center. In the final comprehensive report, Hall and Lyford (2001) described methodology, results and recommendations. A Task Force created in this initiative recommended key areas for the industry to pay attention including communications, marketing coordination, market analysis, applications of new technologies, water problems, access to latest research, and post-harvest improvements. One of the conclusions considered that the Texas vegetable industry is very complex, requiring collective efforts to bring changes and progress. That initiative addressed the development of an onion exchange program, promotion campaigns for Texas produce and prioritization of areas for potential legislative funding. Specific programmatic legislative annual requests were: Food for Health Programs ($2.0 Million), Research and Management Programs ($1.5 Million), and Marketing Programs ($980,000).

The SWOT Process and Methodology

SWOT is a management technique (strategic tool) developed at Stanford University in the 1960's using data from Fortune 500 companies. It evaluates strengths (S), weaknesses (W), opportunities (O) and threats (T) in achieving objectives. SWOT identifies internal factors and external conditions that are favorable and unfavorable to achieve specific objectives (Houben et al., 1999; Kaplan et al., 2008). Strengths relate to competitive advantages (e.g. resources, competencies), weaknesses are limitations that hinder progress, opportunities are conditions favorable for achieving goals, and threats are conditions harmful in achieving goals.

The Texas A&M AgriLife Administration requested the development of a SWOT analysis to assess the strengths, weaknesses, opportunities and threats of the Agency ('internal') with respect to Vegetable and Fruit (V&F) programs and capabilities. Similarly, an external SWOT analysis was conducted with the Texas Vegetable and Fruit industry. The SWOT analysis summarizes the information to assist the executive team understand key issues that AgriLife must consider when formulating strategies. The goal of this process is to develop short- and long-term strategic planning of the Agency programs and to better serve the needs of the V&F industry in Texas. The AgriLife planning committee included Bhimu Patil, Marco

Palma, Parr Rosson, Juan Landivar, Monty Dozier and Daniel Leskovar (as Chair). Additional support was provided by Bill McCutchen, Carl Muntean and Bob Avant from the Corporate Relations Office. During the first phase (January-March 2012) the committee held several discussions via teleconference, emails and through regional visits to outline steps, procedures, and mechanisms for the development of the internal and external SWOT. In order to formulate internal and external survey questions, two comprehensive knowledge-based focus group workshops were organized, one in Uvalde and another in College Station. During these workshops there were discussion about AgriLife internal capabilities, the V&F position of the Texas industry in the U.S., applied and fundamental Research/Extension programs and critical issues affecting the AgriLife Agency and the V&F industry in Texas. An internal AgriLife survey was developed and sent to research and extension faculty within the system. This report summarizes the results of the internal survey.

During the second phase (March and April 2012) the committee engaged in regional industry focus group workshops, leading to seek input for the development of external Industry survey questions. Those workshops were conducted in four economically important V&F areas in Texas: McAllen (representing the Lower Rio Grande Valley region), Uvalde (Wintergarden), Lubbock (High Plains) and El Paso (West Texas). The external survey was developed and in July 2012 was presented to the Institutional Review Board (IRB) for approval. The survey was conducted immediately after approval.

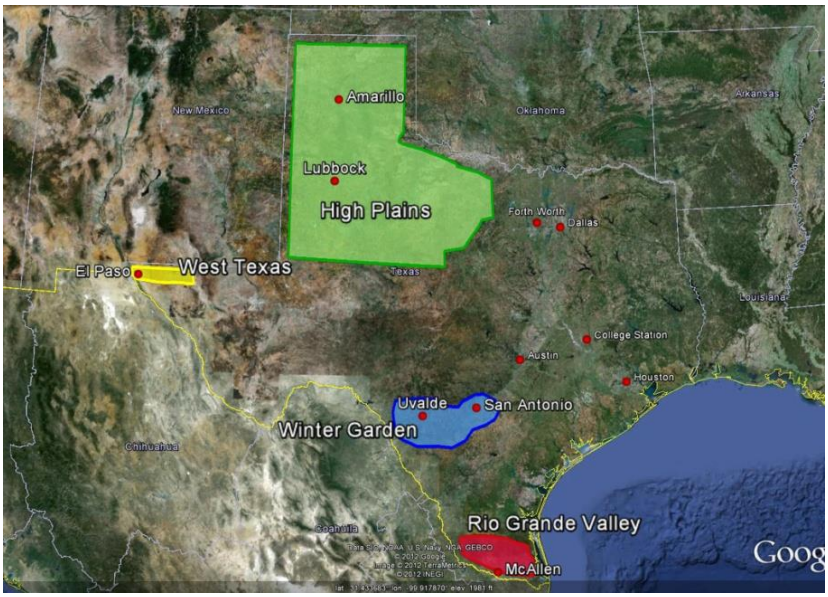

Figure 2. Major production regions of vegetables and fruits in Texas.

We acknowledge the collaboration of Russ Wallace (Lubbock) and Jaime Iglesias (El Paso), industry members Ray Prewett, Jed Murray (LRGV) and Jay Carnes (Wintergarden), and to Alicia Novoa from PPRI as well as faculty in Texas AgriLife involved in vegetable and fruit programs.

Internal Texas A&M AgriLife SWOT Analysis of Vegetable & Fruits

Focus Group Workshop - Uvalde

The goal of this workshop was to discuss critical issues - positive and negative - of the Vegetable and Fruit sectors in Texas as well as the impact and limitations of Texas A&M AgriLife Research and Extension programs. Specific objectives were to:

1. Gain comprehensive background information about past and present trends related to production, consumption and economics of the V&F sectors in Texas and the Texas position in the U.S. markets;
2. Understand and showcase other experiences such as SWOT on Biofuels and survey methods on dairy and other farmers;
3. Collect metrics data for drafting 'internal' survey questions;
4. Conduct the first 'internal' SWOT analysis;
5. Discuss process and timeline for the development of statewide regional "external" workshops and SWOT aimed at developing 'external survey' questions.

On February 9-10, 2012 a total of 24 faculty affiliated with Texas A&M AgriLife Research and Extension Agencies participated in a knowledge-based focus group workshop. Participants attending represented the main production regions of Texas, including the LRGV, Wintergarden, Central, High Plains and West Texas. The planning committee agreed to conduct the second focus group workshop in College Station, Tuesday March 6, 2012.

Focus Group Workshop – College Station

The goal of the second workshop was to further discuss critical research issues of the Vegetable & Fruit sectors in Texas as well as the impact and limitations of Texas A&M AgriLife Research programs. Specific objectives were:

1. Gain comprehensive background information about health and nutrition of V&F; impact of breeding, environment, and cultural practices on phytochemical compounds; consumer's perceptions for functional foods; and role of V&F in sports nutrition;
2. Collect additional metrics data for drafting 'internal' survey questions;
3. Conduct the second 'internal' SWOT analysis;
4. Discuss process and timeline development and IRB approval of survey questions

On March 6, 2012 a total of 24 faculty (9 were repeats from the first SWOT) affiliated with Texas A&M AgriLife Research and Extension, TAMU College Station and Kingsville, and Baylor College of Medicine participated in the knowledge-based focus group workshop.

Survey Results

A total of 87 participants clicked the link to take the internal survey, with the number of participants decreasing as they progressed though the survey, perhaps as a result of the length of the survey, complexity of some questions and the fact that respondents were forced to answer each question. The number of participants who responded every single question in the surveys was 63. Additional information provided in the text boxes in the survey was included with each question along with the number of respondents per question. It is important to note that while responses in the text boxes provide useful input, when interpreting the results they only represent a small fraction of respondents (1.6% for n=63).

1. If you conduct research and/or extension education in F&V, what is your **primary discipline?**

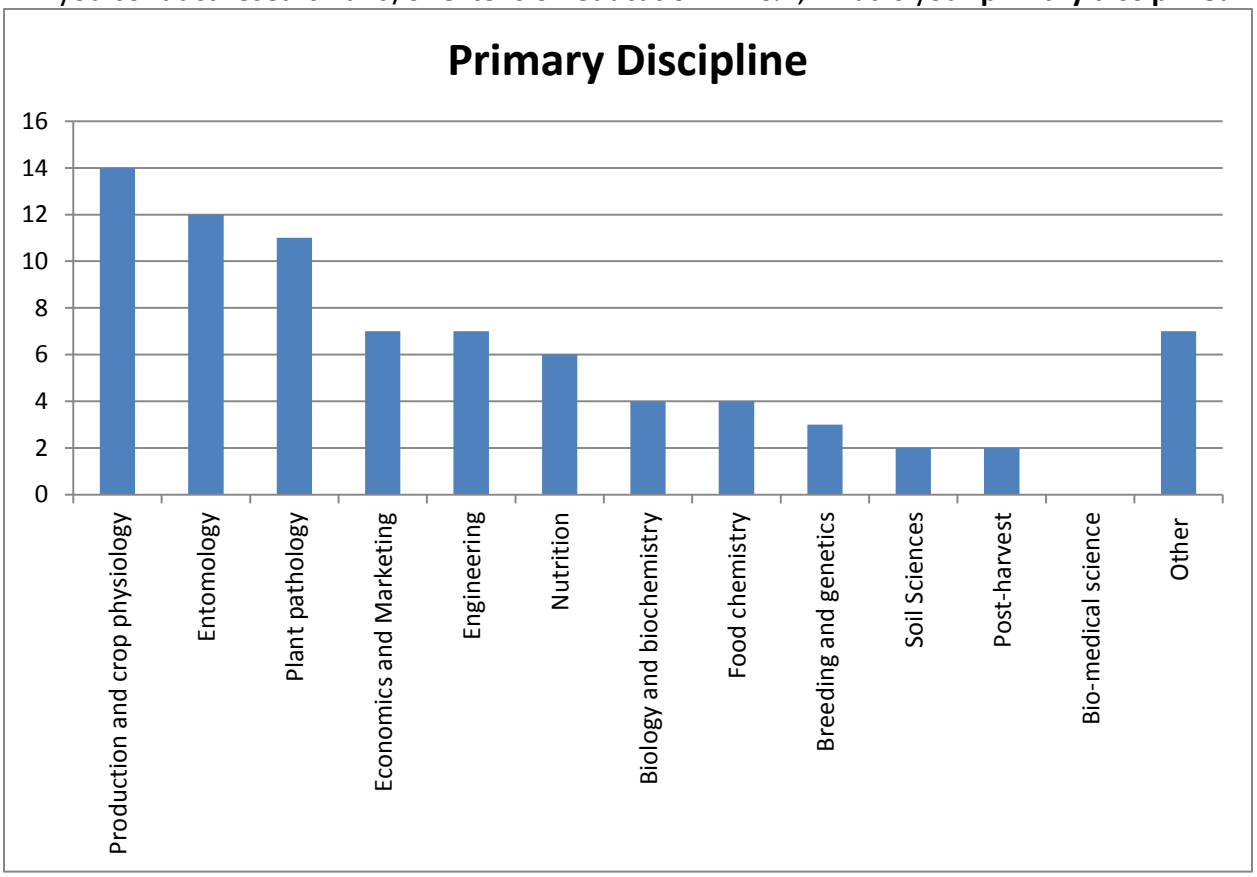

Figure 3. Primary discipline. n=79

The predominant discipline was production and crop physiology (18%), followed very closely by entomology (15%) and plant pathology (14%). There was also good representation of economics and marketing (9%), engineering (9%) and nutrition (8%). Other disciplines with fewer responses included: food chemistry (5%), biology and biochemistry (5%), breeding and genetics (4%), soil sciences (3%) and post-harvest (3%). There were no responses from biomedical science. Other category with less *than 2% of respondents included:* Consumer education; Food safety; Modeling, environmental, production and economic risk assessment; Director of research and Microbiology.

2. How extensively do you work with the following crops?

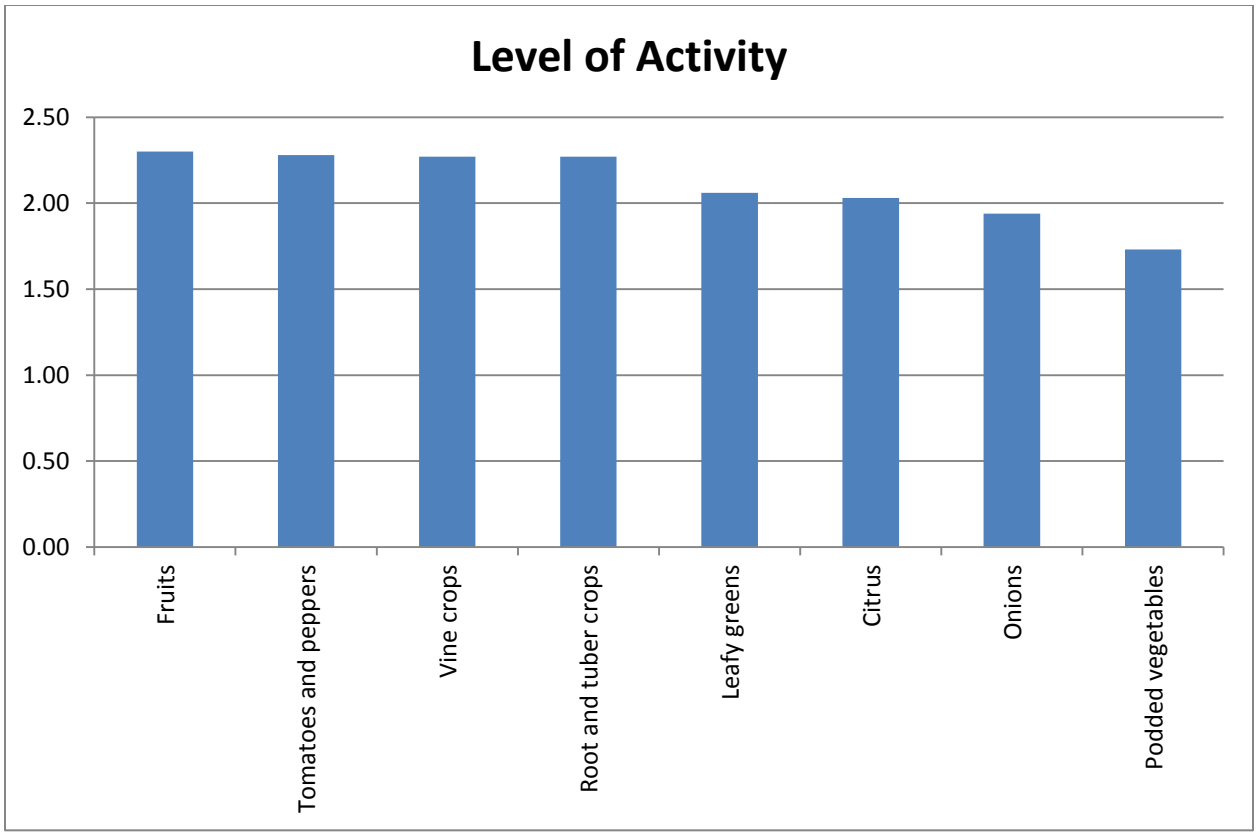

Figure 4. Level of activity by crop groups. n=71. Scale: 1-4. 1=none, 2= low, 3= moderate, 4=high

Overall there was a good mixture in the level of activity for a variety of crops across AgriLife. Fruit products had the highest level of activity with a mean value of 2.30. This is probably due to the fact that all fruit crops were grouped together in a very general category. Of the vegetable crops, tomatoes and peppers had the highest level of activity with a mean of 2.28, followed very closely by root and tuber crops (beets, potatoes, carrots, etc), vine crops (watermelon, honeydews, cantaloupes, etc) with a men value of 2.27 for both categories. Leafy green crops (lettuce, cabbage, spinach, etc) had a mean value of 2.06, while citrus crops had a mean value of 2.03). Onions and podded vegetables had mean values below the low level (2.0) with 1.94 and 1.73 respectively.

3. Level of activity of the following areas (pre-harvest)

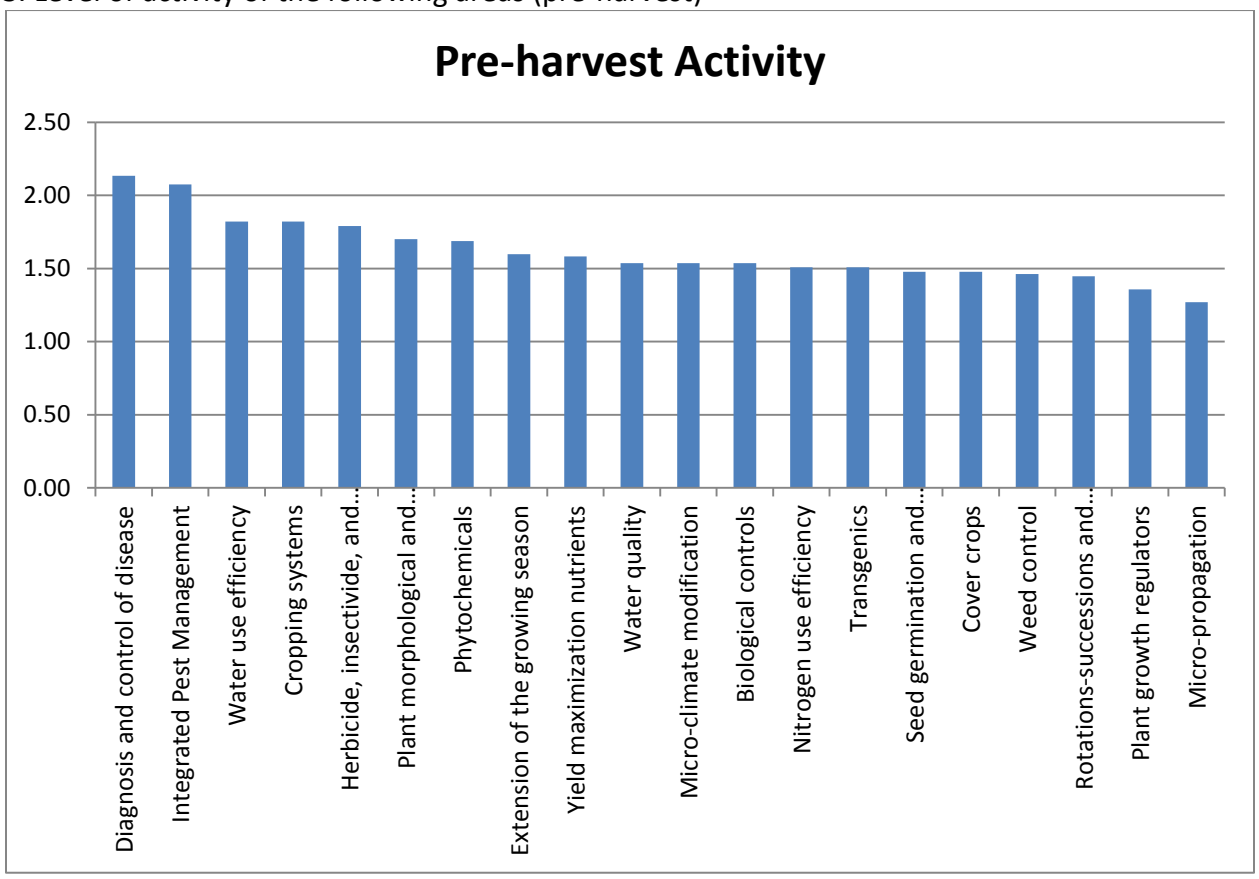

Figure 5. Level of activity of pre-harvest areas. n=67. Scale: 1-4. 1=none, 4=high

The level of pre-harvest activity had almost a uniform shaped distribution, with mean values ranging from a low of 1.27 for micro-propagation to a high of 2.13 for diagnosis and control of diseases. Activities with a mean value higher than 1.5 included: diagnosis and control of disease (2.13), integrated pest management (2.07), water use efficiency (1.82), cropping systems (1.82), herbicide, insecticide and fungicide research and development (1.79), plant morphological and physiological adaptation mechanisms to environmental stress (1.70), phytochemicals (1.69), extension of the growing season (1.60), yield maximization through plant nutrient requirements (1.58), water quality (1.54), biological control of soil borne diseases (1.54), micro-climate modification (1.54), transgenics (1.51), and nitrogen use efficiency (1.51).

4. Level of activity of the following areas (post-harvest)

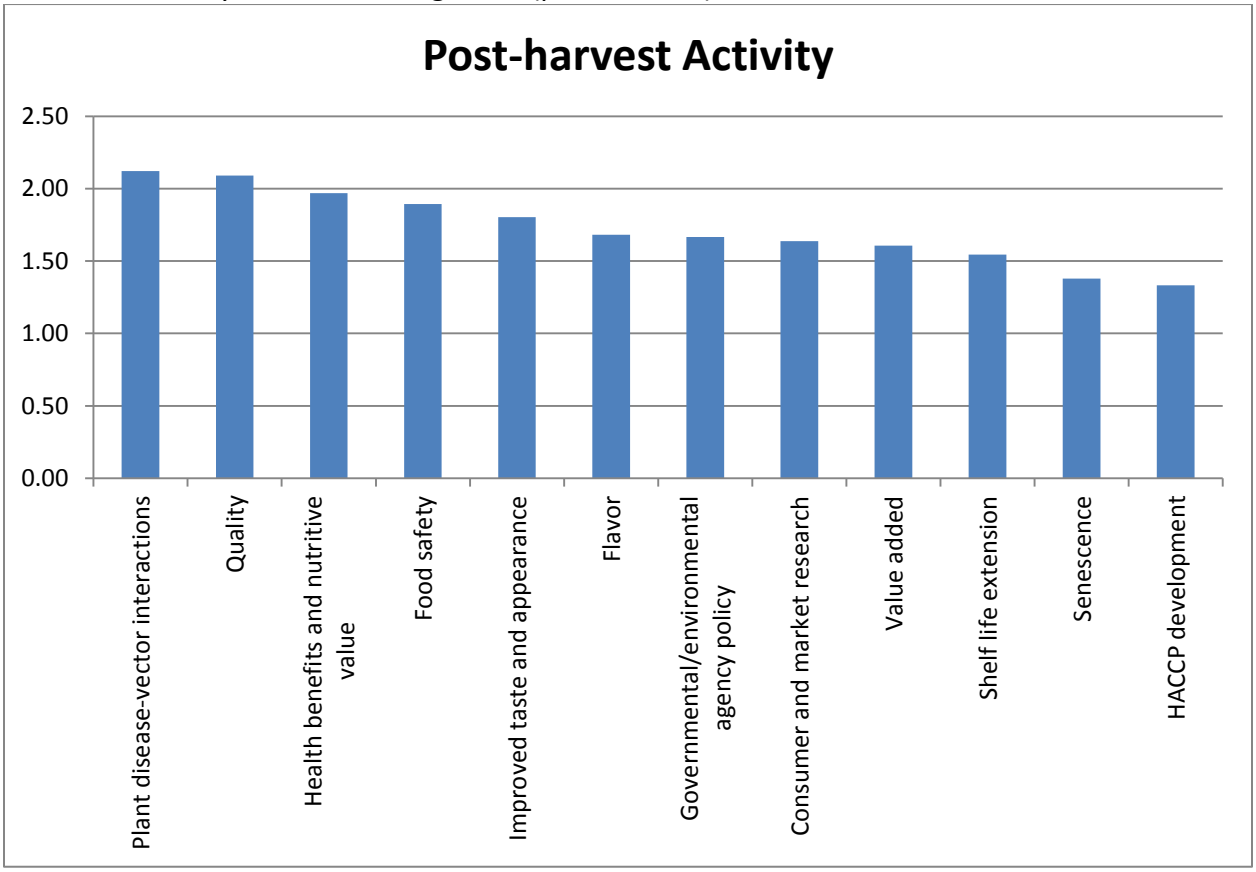

Figure 6. Level of activity of post-harvest areas. n=66. Scale: 1-4. 1=none, 4=high.

Similarly to the pre-harvest results, post-harvest activity also had a similar distribution. The post harvest areas with the highest level of activity were plant disease-vector interactions and quality with mean values of 2.12 and 2.09, respectively. Other areas with a mean value of at least 1.5 included: health benefits and nutritive value (1.97), food safety (1.89), improved taste and appearance (1.80), flavor (1.68), Governmental/environmental agency policy (1.67), consumer and market research (1.64), processing technologies for value added (1.61), and mechanisms involved in shelf life extension. The only category with a value of less than 1.5 was post-harvest related to senescence and HACCP development.

5. Please identify other areas that AgriLife Research and Extension could and should address and/or support.

Production

- Irrigation and water management
- Germplasm and commercial variety evaluations / Genotype x Environment interactions (multi-location evaluations)
- Season extension; protected agriculture; sustainable and organic agriculture production and marketing
- Stress physiology
- Environmental and genotypic interaction and their effect on phytochemicals

Breeding

- The use of marker assisted breeding to develop varieties/lines that can be efficient and productive for all regions of vegetable and fruit production in Texas
- Breeding vegetables and fruits for enhanced health benefits, disease and pest resistance
- Need efforts on diagnosis, control, and resistance breeding for complex of vegetable viruses increasing in southern parts of Texas in association with climate warming, especially whitefly vectored viruses

Diseases

- Address soil-borne pathogens that do not kill but may reduce yields.
- Diagnostics of vegetable diseases using classical and molecular tools via Plant Clinics
- Seed treatments (fungicide, bacterial)
- Emerging diseases (already in Texas or heading this way)
- Vegetable virus identification

Insects

- There is no ant bait product approved for certified organic crops. We hope to work with Dow AgroSciences to acquire a spinosad bait product registration for use in these crops). Raspberry crazy ants, a Nylanderia species, are invading Texas and may have an impact on fruit and vegetable production systems infested in the future. There is no ant bait product available and/or registered for their control.

Health Benefits

- Quality, flavor and health and nutritive value of vegetables and fruits
- Higher quality products with an emphasis on health benefits
- The above research should be extended to understand the benefits of vegetables and fruits to reach to consumers. More research is needed to see the levels of

these compounds, why the color and sensory attributes are changing and what are the benefits?

- Much more support needs to go into the end use of the V&F research conducted at TAMU. You only have to look at the list of fundable/research areas on the last few pages to see how little emphasis is placed on how people benefit from them, and here I am addressing basic, mechanistic research.

Food Safety

- Use of chemical interventions and decontaminants for food safety improvement in fresh and minimally processed produce.
- I am not completely familiar with all that is currently being done, but in general there is a great need for public education related to production practices for health safety - for example I have read articles on how one should buy organic produce if the skin is to be eaten rather than peeled due to heavy chemical use - as well as post-harvest methodologies and their safety. Other information that needs to be compiled and evaluated includes the feasibility and desirability of feeding the world with small plot organic production. What land use practices does "factory farming" currently employ and are they decimating the land? This is a frequent claim. It seems there is a need to review research and try to arrive at a consensus.

Communication/Grower Outreach

- Facilitation of harnessing the internet to benefit stakeholders on a commodity by commodity basis. This interactive real-time resource can link research/extension/producer communities so that information flow is ubiquitous and instantaneous in all directions. The quality and organization of that information content can be proscribed by commodity stakeholders based on their mutual needs. The information is then used to produce value added deliverables that impact the commodity.

Economics and Marketing

- A big concern for everyone is food cost due to increased fuel prices. So much of our food is grown either in large commercial operations or in other countries. What will happen when energy prices put the distribution system at risk? A related problem in Texas is land fractionation - everyone wants a 10-20 acre piece of land and then does not know what to do with it. While there are a number of commodities that can be grown as truck crops on such parcels, they are not competitive with large scale production facilities that rely on transportation infrastructure to carry goods to market. Preparing for local production and distribution is a topic in the blogosphere, but I do not know where AgriLife/A&M is positioned. With the surging interest in vegetarian diets, healthy food choices are important but expensive. Profitable local production of food crops, especially winter crops north of I10 that cover the spectrum of

human nutritional need seems out of reach at this time and that makes it a challenging grant target.
- Marketing information and promotion

Personnel Needs
- Need additional breeder/geneticist to work on important vegetable crops-currently down to 1 person in AgriLife compared to 6 scientists 15 years ago.
- I would like to see more emphasis on postharvest physiology and handling. Previously, vegetable pathology, entomology were areas of desperate need; however, in recent years, with the Zebra Chip research funding, this situation has improved, but activity is limited to the ZC complex.
- Increased support for 'green' industry in Texas, including nursery phytosanitary protocols.

6. Please rank the top 5 priority areas from the crop management areas question that you believe need the additional resources for research and/or education for AgriLife to increase its overall impact for Texas producers through consumers?

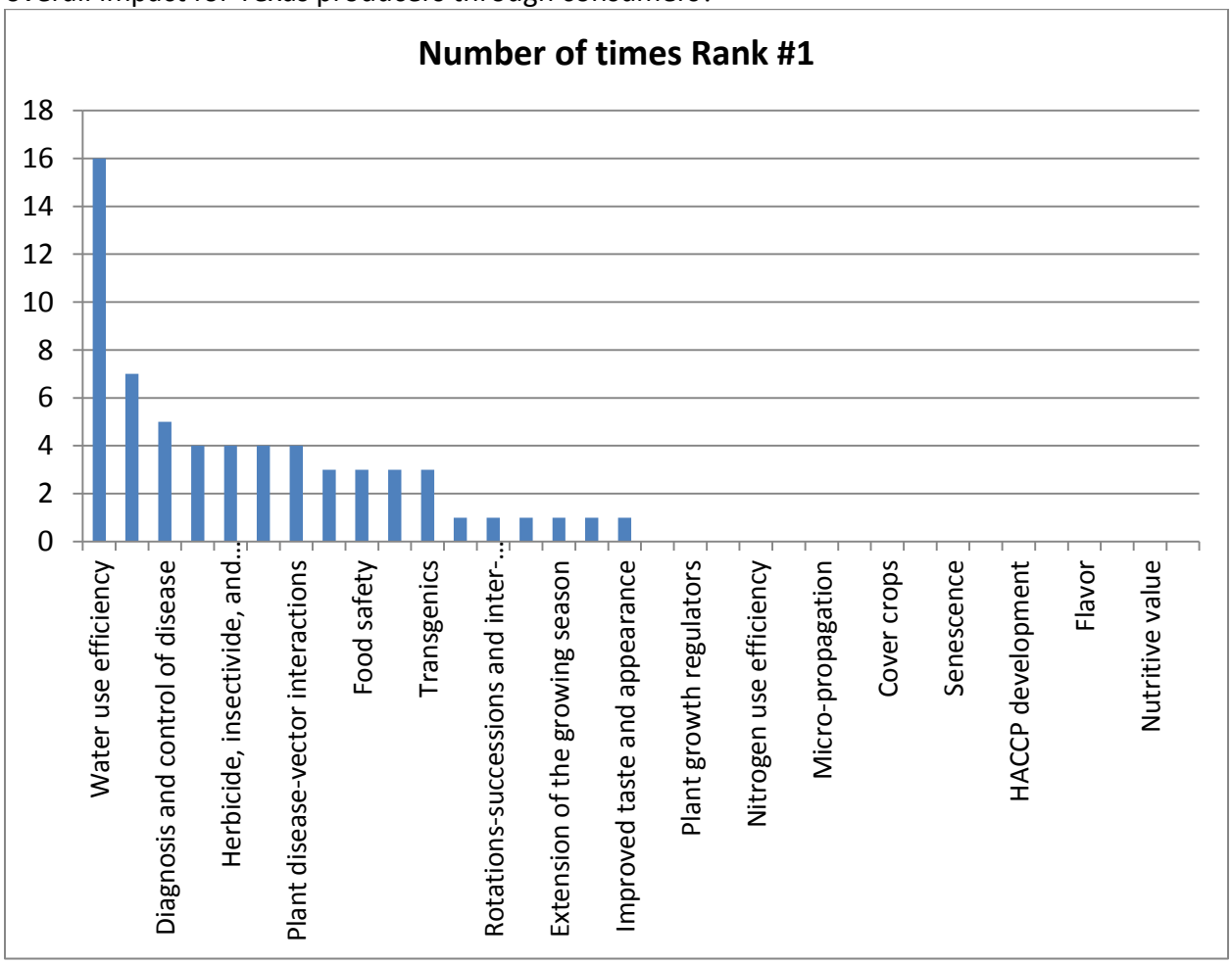

Figure 7. Number of times area was ranked as the top priority. Some categories are not shown due to space (e.g. IPM second to water use efficiency) but described in the narrative below.

Figure 7 shows the number of times each category was selected as the top priority issue that needs additional resources for research and/or education for AgriLife to increase its overall impact. The top issue reported by respondents was clearly water use efficiency. This category was ranked as the top priority issue 16 times. It was followed by integrated pest management (7 times), diagnosis and control of disease (5 times), consumer and market research (4 times), phytochemicals (4 times), herbicide, insecticide and fungicide research and development (4 times), plant disease vector interactions (4 times), plant morphological and physiological adaptation (3 times), food safety (3 times), health benefit (3 times), and transgenics (3 times). Categories selected as the top priority area one time include: cropping systems, rotations-successions and intercropping, post-harvest management, extension of the growing season, value added, and improved taste and appearance.

As expected, this question/answer seems to be correlated with the main areas of work by the respondents, with the top issues being considered within some of the same disciplines. In addition to the number of times an area was selected as the top priority, Figure 6 shows the total count of the number of times a topic area was selected as one of the top five priority areas. Water use efficiency was still the top priority area appearing 31 times, followed by food safety (19 times), cropping systems (19 times), plant morphological and physiological adaptation mechanisms to environmental stress (18 times), diagnosis and control of disease (18 times), health benefits (16 times), quality (15 times), integrated pest management (14 times), herbicide, insecticide and fungicide research and development (14 times), consumer and market research (13 times), plant-disease vector interactions (13 times), phytochemicals (10 times), transgenics (10 times), nutritive value (9 times), governmental/environmental agency policy (9 times), processing technologies for value added (8 times), improved taste and appearance (8 times), nitrogen use efficiency (7 times), rotations-successions and intercropping (7 times), extension of the growing season (6 times), cover crops that fill management goals of producers (6 times), flavor (6 times), yield maximization through plant nutrient requirements (5 times), post-harvest management (5 times), biological control of soil borne diseases (5 times), water quality (4 times), weed control (4 times), post-harvest related to senescence (3 times), micro-climate modification (3 times), plant growth regulators (2 times), mechanisms involved in shelf life extension (2 times), HACCP analysis (1 time). Seed germination and transplant quality and micro-propagation were not ranked as the top priority. Figure 6 presents the number of times a topic area was ranked in the top 5 by area of work. Respondents from the production and crop physiology discipline ranked water use efficiency (8 times), cropping systems (5 times), quality (4 times) and herbicide, insecticide, and fungicide R&D (4 times) as their top areas. Plant pathologists ranked diagnosis and control of disease (9 times), plant disease vector interactions (7 times), and herbicide, insecticide and fungicide R&D as their top areas. Entomologists ranked integrated pest management (8 times), water use efficiency (6 times) and herbicide, insecticide, and fungicide R&D (5 times) as their top priority areas. Respondents from the Agricultural economists and policy area ranked government/environmental agency policy (5 times), consumer and market research (4 times), and food safety (4 times) as their top priority areas. The rest of the rankings are shown in Table 1.

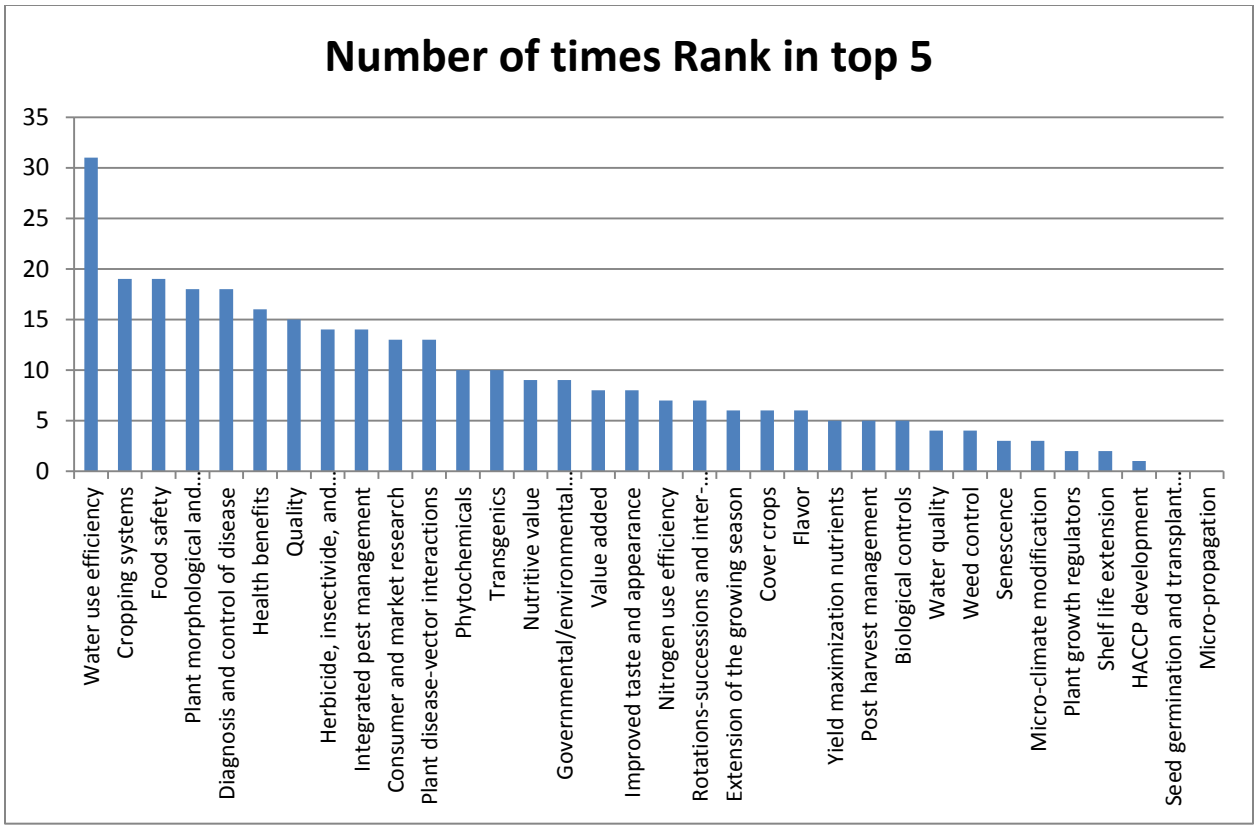

Figure 8. Number of times area was selected as one of the top 5 priorities.

Table 1. Number of times area was selected as top-5 priority by area of work

Area	Prod and crop physiology	plant pathology	Entomology	Soil sciences	Economics	Breeding	Engineering	Post-harvest	Biology	Nutrition	Food chemistry	Bio-medical	Other	Total
Phytochemicals	0	2	1	0	0	0	0	0	2	1	3	0	1	10
Water use efficiency	8	4	6	1	3	2	1	1	1	1	0	0	3	31
Water quality	0	0	0	0	1	0	0	0	1	0	0	0	2	4
Plant growth regulators	0	0	1	0	0	0	0	0	1	0	0	0	0	2
Herbicide, insectivide, and fungicide R&D	4	5	5	0	0	0	0	0	0	0	0	0	0	14
Yield maximization nutrients	1	0	0	1	0	1	1	0	1	0	0	0	0	5
Nitrogen use efficiency	3	0	0	1	0	1	0	0	0	0	0	0	2	7
Plant morphological and physiological adaptation	3	4	4	0	0	1	0	1	1	1	0	0	3	18
Cropping systems	5	2	5	0	1	1	1	0	0	1	1	0	2	19
Seed germination and transplant quality	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Micro-propagation	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Rotations-successions and inter-cropping	2	1	2	0	0	0	0	0	0	1	0	0	1	7
Weed control	2	0	0	1	0	0	0	0	0	0	0	0	1	4
Diagnosis and control of disease	2	9	2	0	1	2	0	1	0	0	0	0	1	18
Post harvest management	0	1	1	0	0	1	0	0	1	0	0	0	1	5
Extension of the growing season	5	0	0	0	1	0	0	0	0	0	0	0	0	6
Cover crops	2	0	2	0	0	0	0	0	0	0	0	0	2	6
Biological controls	1	3	0	0	0	0	0	0	0	1	0	0	0	5
Senescence	0	1	1	0	0	0	0	1	0	0	0	0	0	3
Value added	0	0	0	0	2	0	0	2	2	0	2	0	0	8
Shelf life extension	0	0	1	0	0	0	1	0	0	0	0	0	0	2
Food safety	2	2	0	0	4	2	1	2	1	3	0	0	2	19
HACCP development	0	0	0	0	0	0	0	0	0	0	0	0	1	1
Micro-climate modification	2	0	1	0	0	0	0	0	0	0	0	0	0	3
Flavor	1	0	0	0	0	0	0	0	1	1	3	0	0	6
Quality	4	1	0	0	1	1	2	1	2	1	2	0	0	15
Consumer and market research	3	0	0	0	4	0	1	0	0	4	0	0	1	13
Plant disease-vector interactions	1	7	5	0	0	0	0	0	0	0	0	0	0	13
Integrated pest management	2	3	8	0	0	0	0	0	0	0	0	0	1	14
Improved taste and appearance	2	0	0	0	1	1	1	0	0	1	1	0	1	8
Nutritive value	2	0	0	1	2	0	0	0	0	4	0	0	0	9
Health benefits	2	0	0	0	4	1	1	1	0	4	3	0	0	16
Transgenics	1	4	3	0	0	1	0	0	1	0	0	0	0	10
Governmental/environmental agency policy	0	1	2	0	5	0	0	0	0	1	0	0	0	9

Q.7. How would you rate the following facets of AgriLife Research and Extension as it relates to Fruit and Vegetable programs?

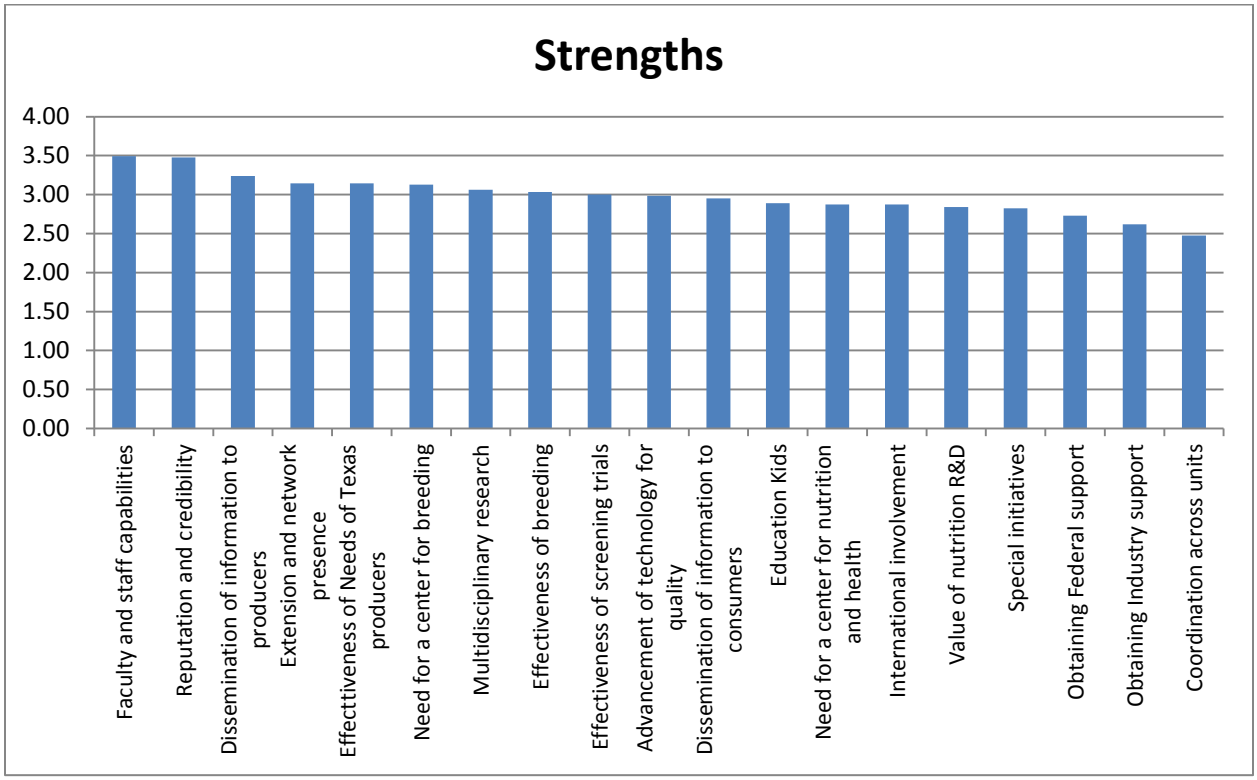

Figure 9. Strengths of Texas AgriLife F&V Programs. n=63. Scale: 1-5. 1=poor, 5=outstanding.

In relation to the strengths of Texas AgriLife as it relates to fruit and vegetable programs, faculty and staff capabilities (3.49) and reputation and credibility (3.48) were ranked at the top. Other important factors with a mean score of 3.0 or higher included: dissemination of information to producers (3.24), effectiveness of addressing the needs of Texas based producers (3.14), extension and network presence (3.14), need for a center focusing on breeding and evaluation of new varieties (3.13), multidisciplinary research programs (3.06), effectiveness and resources for developing/breeding new varieties (3.03), effectiveness of screening and demonstration trials (3.00).The categories with the lowest ratings were coordination of vegetables and fruit programs across units (2.48), obtaining industry support (2.62) and obtaining federal support (2.73).

8. How would the following threats impact Texas AgriLife?

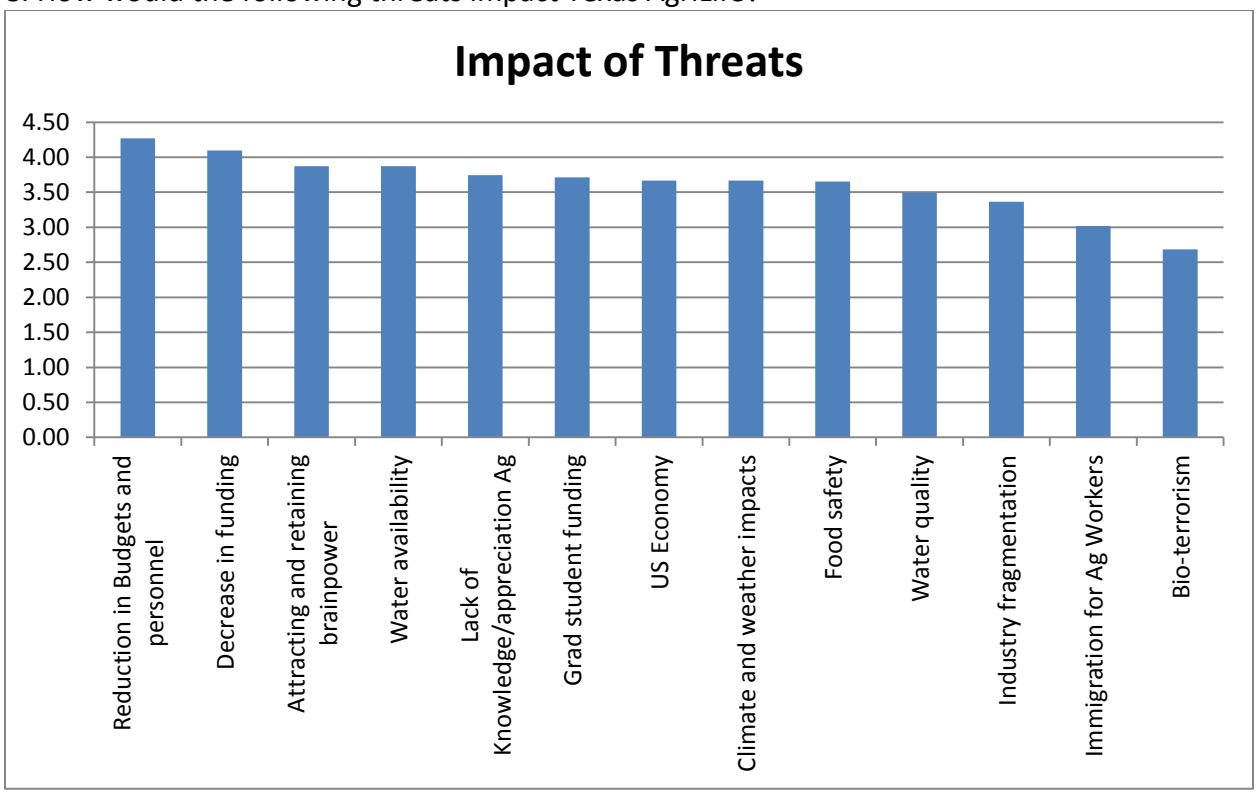

Figure 10. Impacts of threats to Texas AgriLife F&V Programs. n=63. Scale: 1-5. 1=Very Low, 2=low, 3=medium, 4=high, 5=Very high

Reduction in budgets and personnel (4.27) was ranked as the top threat to the success of Texas AgriLife fruit and vegetable programs. Decreasing in funding opportunities and more competition for funding (4.10) was the second highest threat by respondents. Others with at least a medium rating as a threat to fruit and vegetable programs included: attracting and retaining brain power (3.87), water availability (3.87), lack of knowledge/appreciation for agriculture (3.75), graduate student funding and support (3.71), the state of the US economy (3.67), climate and weather impacts (3.67), food safety (3.65), water quality (3.49), industry fragmentation (3.37), and immigration situation for agricultural workers (3.02). Bio-terrorism (2.68) was the lowest threat as viewed by respondents.

9. What is the level of impediment (Weaknesses) to Texas AgriLife Fruit and Vegetable programs?

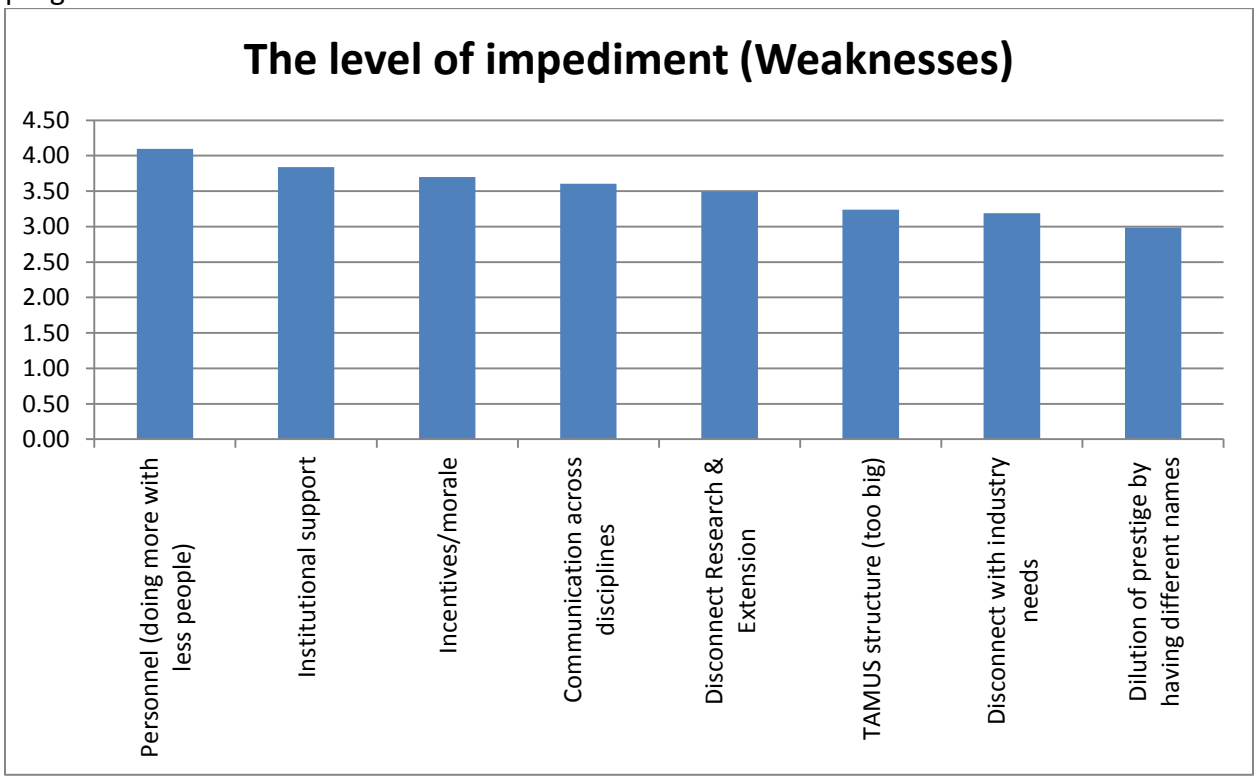

Figure 11. The level of impediment of the following aspects to the success of AgriLife F&V Programs. n=63. Scale: 1-5. 1=Very Low, 2=low, 3=medium, 4=high, 5=Very high

The top weakness for Texas AgriLife as it relates to fruit and vegetable programs is in regards to personnel (4.10), doing more with less people. Institutional support (3.84) was also ranked very high as a weakness for fruit and vegetable programs. Other weaknesses with at least an average ranking corresponding to medium importance included: incentives/morale (3.70), communication across disciplines (3.60), disconnect between research and extension (3.49), Texas A&M University System organizational structure (3.24), disconnect with industry needs (3.19). Dilution of prestige and identity of having different names had the lowest importance with an average importance rating of 2.98.

10. Potential impacts of the following aspects to Texas AgriLife F&V programs? (Opportunities)

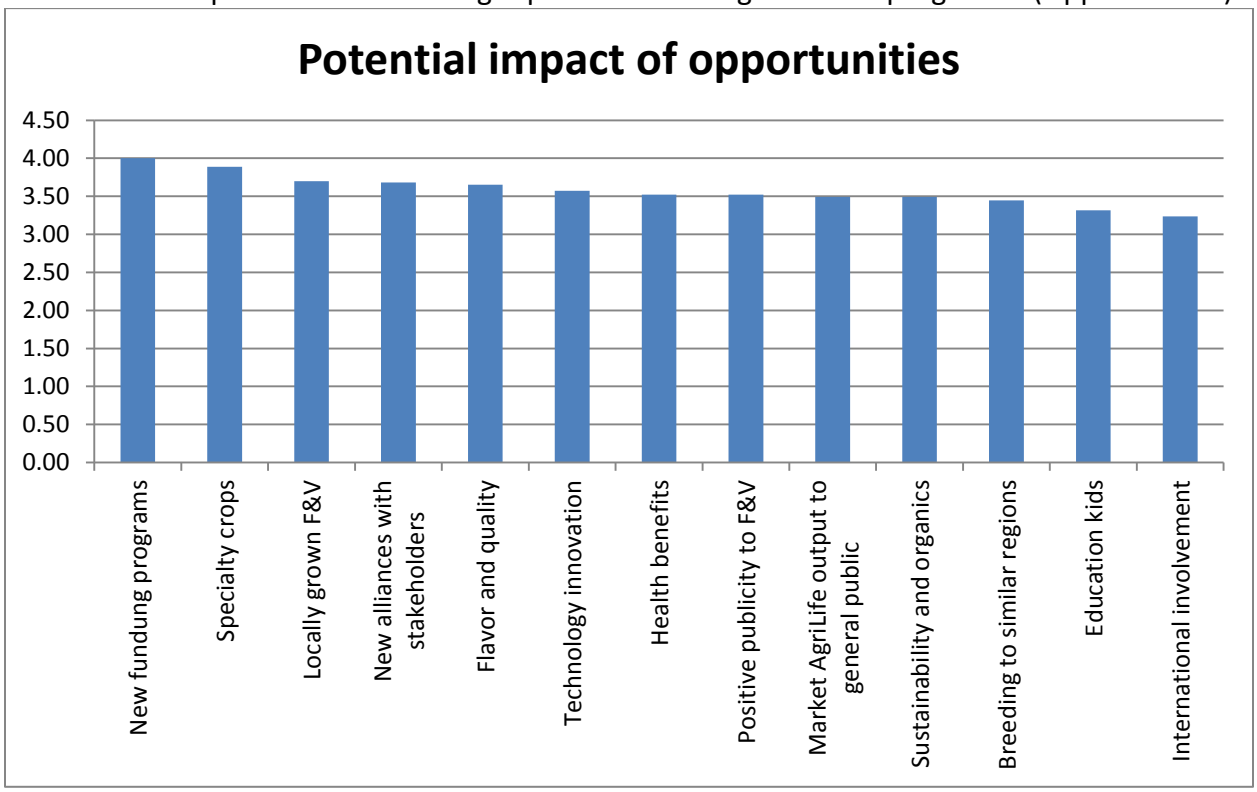

Figure 12. Potential impact of opportunities. n=63. Scale: 1-5. 1=Very Low, 2=low, 3=medium, 4=high, 5=Very high

New funding program opportunities (4.00) was the aspect with the highest potential impact to benefit fruit and vegetable programs across Texas AgriLife. The rest of the areas with potential impact for benefits ranged from 3.24 to 3.89. These aspects included: specialty crops (3.89), locally produced fruits and vegetables (3.70), new alliances with stakeholder associations (3.68), flavor and quality (3.65), technology innovation to enhance programs (3.57), health benefits of fruits and vegetables (3.52), positive publicity of fruits and vegetables (3.52), market AgriLife output to general public (3.49), sustainability and organics (3.49), science of breeding adaptable to other similar regions (3.44), education and outreach for kids and young adults (3.32), and international involvement (3.24).

Other category included:

- Demand for organic and locally produced fruit and vegetables have increased by double digits for the last three years in a row. Even Wal-Mart is promoting local and organic produce. AgriLife is far behind the curve in providing institutional support for the fruit and vegetable industry, let alone the local and organic produce. What institutional support does exist seems to be focused on a few large producers in two distinct regions of the state.
- Accomplishing any of the above goals listed would be tremendously beneficial.

11. Faculty Rank

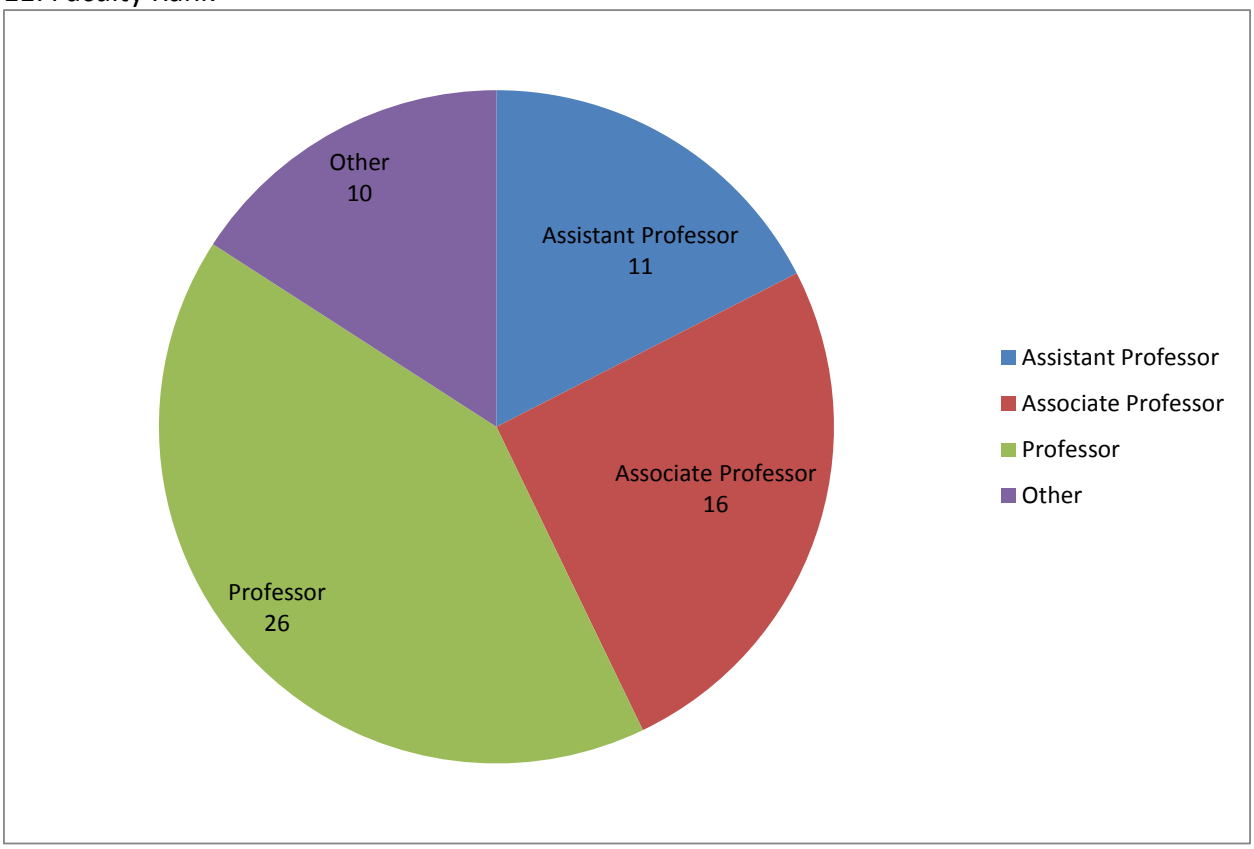

Figure 13. Faculty rank of respondents. n=63

The survey had good representation of all faculty ranks with 41% professors, 25% associate professors, 17% assistant professors and 16% other.
Other category included:

- Extension faculty
- Research Scientist/split appointment with Kilgore College
- Professor Emeritus
- Retired professor with half time appointment
- Professor and Research Director
- Post-doctoral associate
- Resident Director
- Executive Professor and Regents Professor
- Extension Program Specialist

12. Where are you located?

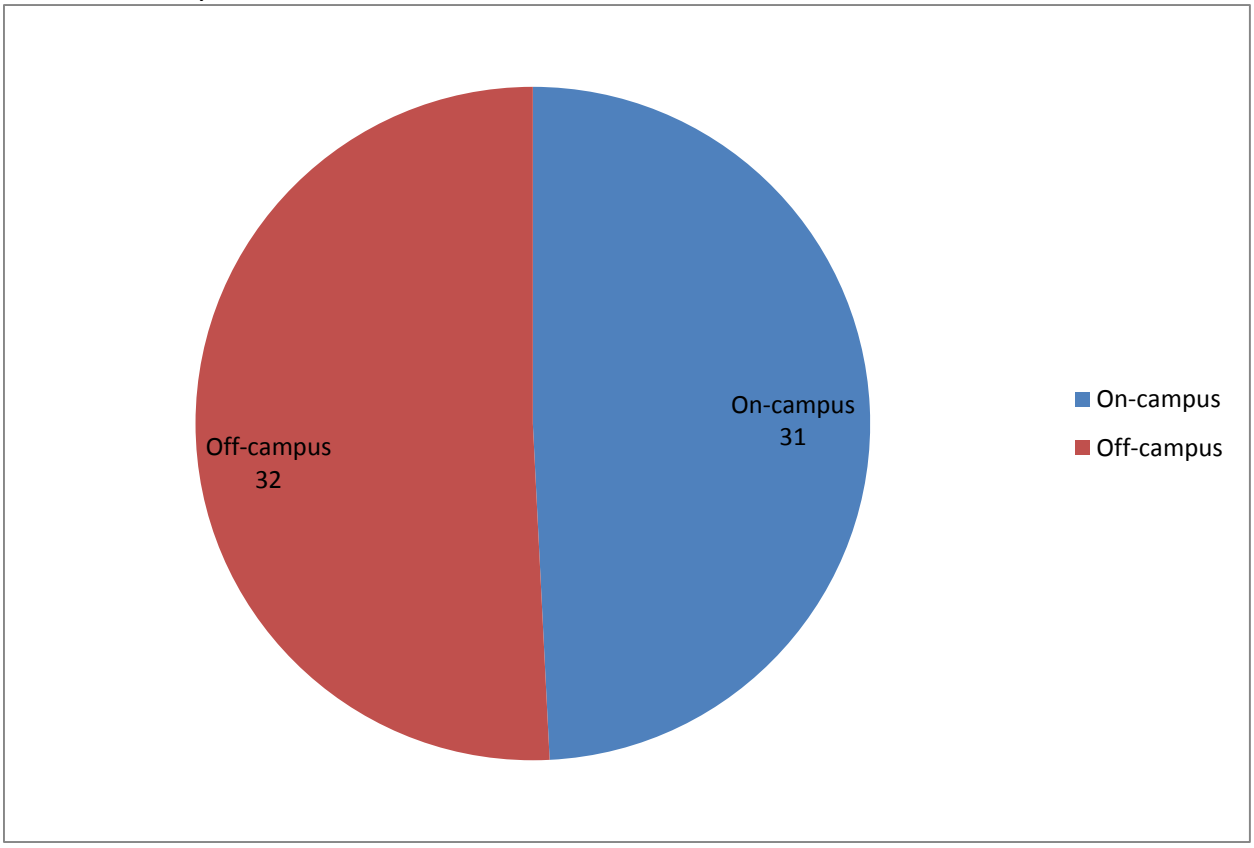

Figure 14. Location of faculty responding to the survey. n=63.

13. Academic Unit

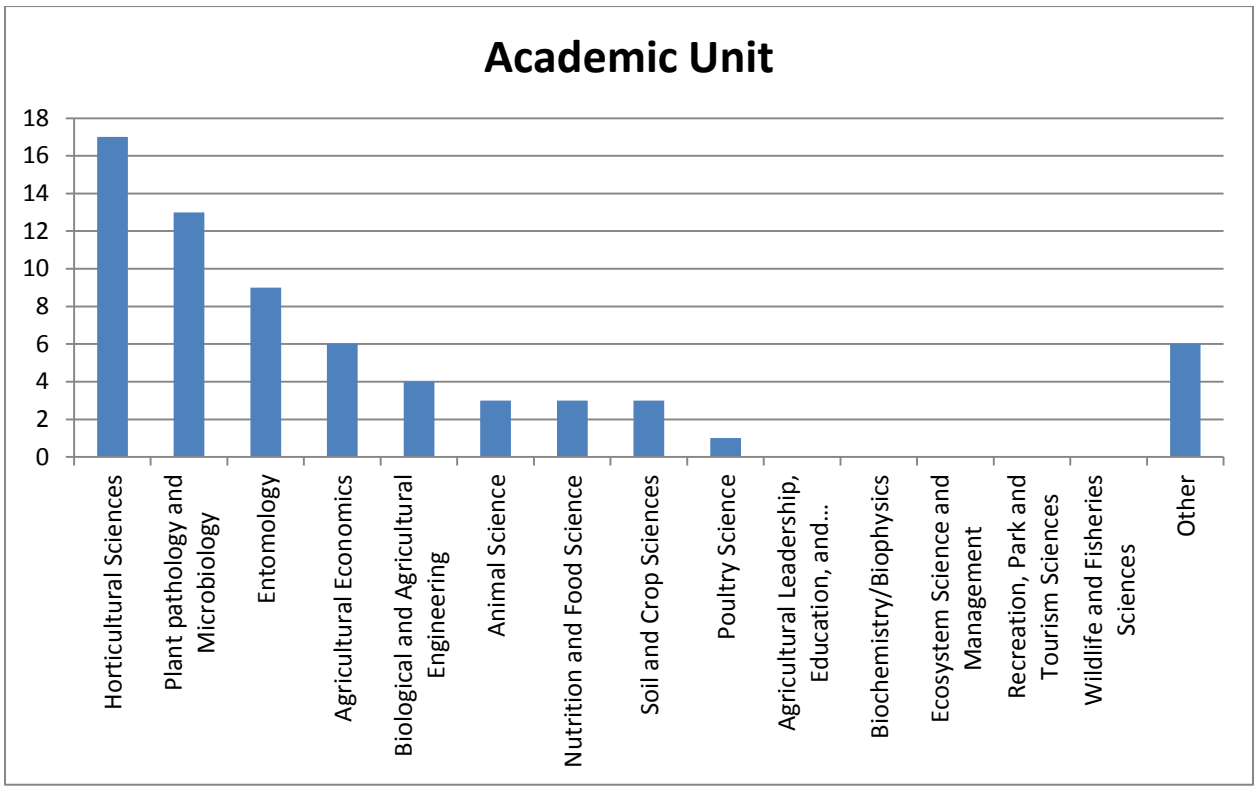

Figure 15. Academic unit of survey respondents. n=65.

Most respondents were from the Horticultural Sciences Department (27%), followed by Plant Pathology and Microbiology (21%), Entomology (14%), Agricultural Economics (10%), Biological and Agricultural Engineering (6%), Animal Science (5%), Nutrition and Food Science (5%), Soil and Crop Sciences (5%), and Poultry Science (2%).

Other category included:

- Extension
- AgriLife Research in Overton - Not associated with a department

External SWOT Process and Methodology

During March-April 2012, the planning committee engaged in regional industry focus group workshops to seek input for the development of an external survey to assess the current state of the fruit and vegetable industry in the State of Texas and to help better serve the needs of the industry. The workshops were conducted in four important V&F growing areas in Texas: McAllen (representing the Lower Rio Grande Valley region), Uvalde (Wintergarden), Lubbock (High Plains) and El Paso (West Texas). The external survey (Appendix A) was developed during May-June, and presented to The Public Policy Research Institute (PPRI) at Texas A&M University in July 2012. The survey was approved by the Institutional Review Board (IRB) on September 10, 2012, and PPRI conducted the survey by phone interviews.

Focus Group Industry Workshop – McAllen

On March 30, members of the planning committee met with eight representatives of the Texas Vegetable and Fruit Industry and conducted a discussion following the SWOT format. The main **threats** highlighted were: water availability, regulations for imports, industry barriers and support, labor costs and skills, food safety, retail marketing strategies, and cost benefits. In terms of **needs** several topics were emphasized: industry support (e.g. multi-commodity check-off program), practical research, breeding adaptive varieties, needs for new crops, safety efforts, and labor programs. The main **strengths** included: importance of regional conditions and geographical locations, demand for produce and marketing advantages, presence of the VFIC.

Focus Group Industry Workshop – Wintergarden

On April 23, members of the planning committee met with eight representatives of the Texas Vegetable and Fruit Industry in the Wintergarden. The main **threats** discussed were: water resources and limitations, regulations, importance of geographical location, labor and food safety issues, product quality and sustainability. In terms of **needs** several topics were emphasized: practical research to minimize risk, breeding and variety testing, crop economics, technical-regional programs and exploring niche markets for specialty crops. Similar to the McAllen meeting the main **strengths** included: importance of regional conditions, geographical locations, regional economy, and synergy between the Uvalde and VFIC for farm-to-table research.

Focus Group Industry Workshop – Lubbock

On April 25, members of the planning committee met with five representatives of the Texas Vegetable and Fruit Industry in the High Plains. The group consisted of one large grower and four small growers including organics. The main **threats** discussed were: regulations, labor issues, food safety and product quality (consumer preferences). For **needs** two topics were emphasized: practical research for small vs. large growers; and crop economics, especially for small farmers. For **strengths** topics included: importance of regional conditions, and seed company support.

Focus Group Industry Workshop – El Paso

On April 26, members of the planning committee met with ten representatives of the Texas Vegetable and Fruit Industry in the El Paso area. This group consisted mostly of two large growers of pecans, and some growers of peppers (processors), onions, pomegranate and nursery crops. The main **threats** discussed were: regulations, water resources and limitations, geographical location and competition for foreign products (pecan). For **needs** there were four main topics highlighted: locally adaptive crop research, technology and breeding, marketing opportunities, regional promotion and health benefits research for pecan. For **strengths** topics included: importance of regional conditions and economy (strong in peppers), foods for health promotion for human consumption, and technical support (comparing NMSU vs. Texas A&M).

Sample size

A list of approximately 200 growers compiled by Daniel Leskovar, Ray Prewett (Texas Vegetable Association) and the Texas Department of Agriculture were provided to PPRI. The list consisted of names, and phone numbers of different companies, growers and brokers in Texas. This list was divided into organic growers (25%) and conventional growers (75%). Consideration was given to avoid duplications of names from the same company.

Methodology

The instrument was programmed using Computer Assisted Telephone Interview software that aids in maintaining track of the different outcomes during each phone call. PPRI identified 15 different interviewers and supervisors that went on training September 17, 2012. These interviewers received extensive training on the instrument and were able to practice how the survey flowed electronically. For example, the interviewers called each other and answered the instrument using different scenarios. On September 18, the survey was officially launched. The telephone survey component was conducted using ICATI to contact the participants and conduct the survey. The interviewers called respondents in a random order based on the sample loaded into the ICATI system. At each call, interviewers requested to speak with participant that had been identified, offered a brief description of the survey and asked them if they would like to participate. Every respondent was informed that all questions were voluntary and they could choose to skip any questions they did not wish to answer.
Call back requests were assigned a "call back" disposition within the ICATI system. The disposition screen allowed the interviewer to enter specific instructions, such as the date and time requested for the call back. The system automatically retrieved the telephone number at the requested date and time and put it into the queue for an interviewer who was logged into the system.

Bad numbers were researched using whitepages.com a free Internet phone listing. If new numbers were found for an employer the record would be retrieved and attempted. However, in most instances these searches did not provide useful information. A few names were identified specifically, and additional information was provided and additional attempts were made. All participants were given an 800 number to call back at their convenience and the PPRI hours of operation were provided for their convenience as well.

1. How many acres of the following crops does your operation grow?

Table 2. Total acres grown per crop.

Crop	Acres Grown	% Acres Grown
Potatoes	20,204.4	20.19%
Pecans	11,175.0	11.17%
Green beans	9,200.0	9.20%
Okra	7,531.5	7.53%
Onions	7,307.6	7.30%
Watermelons	5,498.2	5.50%
Cabbage	5,006.9	5.00%
Grapefruit	4,925.0	4.92%
Spinach	3,863.1	3.86%
Herbs and Spices	2,262.9	2.26%
Wheat	2,200.0	2.20%
Papaya	2,000.0	2.00%
Carrots	1,926.7	1.93%
Grain	1,700.0	1.70%
Oranges	1,561.0	1.56%
Mango	1,500.0	1.50%
Beets	1,430.0	1.43%
Honeydews	1,045.0	1.04%
Broccoli	976.5	0.98%
Collards	846.2	0.85%
Tomatoes	714.4	0.71%
Cantaloupes	664.3	0.66%
Kale	661.1	0.66%
Sweet Corn	584.0	0.58%
Corn	560.0	0.56%
Sugar cane	500.0	0.50%
Mustard	478.8	0.48%
Chili Peppers	436.4	0.44%
Cucumbers	380.3	0.38%
Chard	310.1	0.31%
Squash	258.7	0.26%
Peaches	192.0	0.19%
Bell Peppers	152.5	0.15%
Lettuce	68.0	0.07%
Cauliflower	15.3	0.02%
Sweet Potatoes	2.0	0.00%
Other <= 300 acres	1,912.0	1.91%
Total	100,049.6	

Respondents represented an important sector of the total V&F production in Texas with about 100,000 acres. The predominant crop grown was potatoes (20.19%) with 20,204 acres, following by pecans (11.17%), green beans (9.2%), okra (7.53%) and onions (&.3%). These five crops represented about 55% of the total area grown by respondents. Almost 80% of the area was produced by 12 crops, while the rest accounted for less than 2% each. Other crops were specified if their total area was smaller than 300 acres, and the total accounted for in the "Other" category represented 1,900 acres (Table 2, Fig. 14).

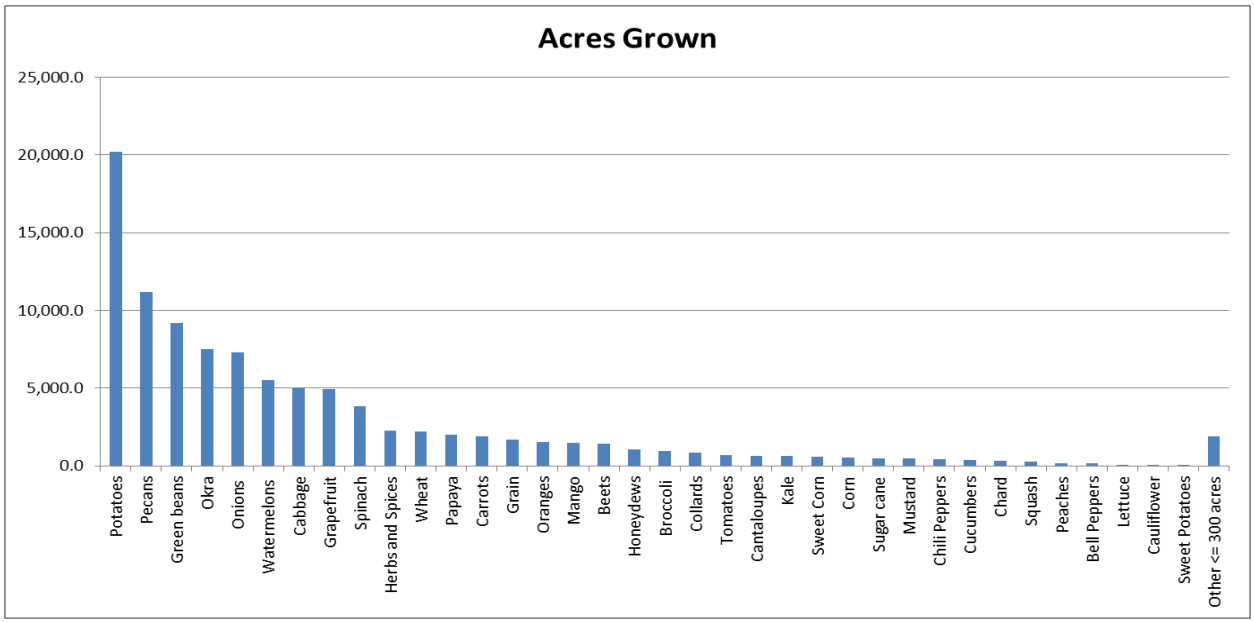

Figure 16. Total acres grown per crop by the respondents.

2. Does your operation include commercial organic production?

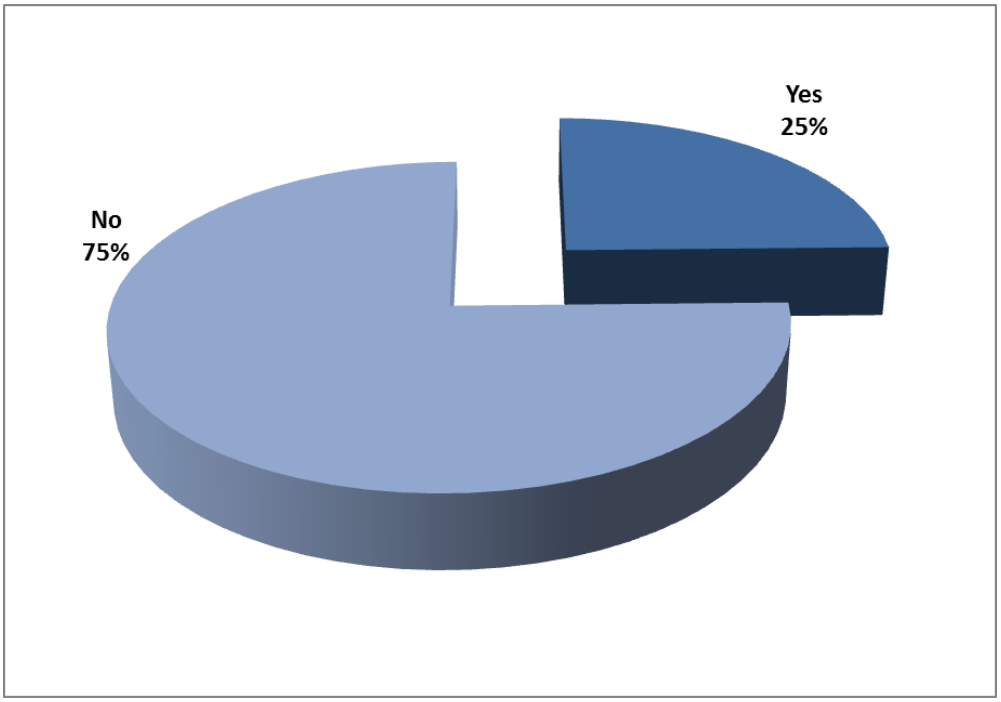

Figure 17. Percentage of operation with organic production (n=77).

About one quarter of respondents (25%) reported to have organic production in their operation (Fig. 17). The area of organic production represented 1,809 acres, which represents 1.3% of the total area covered (conventional and organic production) by the respondents. The amount of commercial organic production by crop is presented in Table 3.

3. How many acres of the following crops were grown organically?

Table 3. Organic Acres grown.

Crop	Organic Acres Grown	Acres Grown (Table 1)	% Organic
Grapefruit	475.0	4,925.0	9.64%
Green beans	400.0	9,200.0	4.35%
Oranges	120.0	1,561.0	7.69%
Carrots	101.6	1,926.7	5.27%
Spinach	101.1	3,863.1	2.62%
Onions	66.5	7,307.6	0.91%
Squash	5.7	258.7	2.20%
Cucumbers	4.2	380.3	1.10%
Potatoes	3.6	20,204.4	0.02%
Cantaloupes	3.5	664.3	0.53%
Watermelons	2.5	5,498.2	0.05%
Lettuce	2.2	68.0	3.23%
Sweet Potatoes	2.0	2.0	100.00%
Tomatoes	1.9	714.4	0.26%
Bell Peppers	1.7	152.5	1.11%
Herbs and Spices	1.5	2,262.9	0.07%
Cabbage	1.4	5,006.9	0.03%
Kale	1.3	661.1	0.20%
Collards	1.2	846.2	0.14%
Mustard	0.8	478.8	0.17%
Chili Peppers	0.6	436.4	0.13%
Broccoli	0.5	976.5	0.05%
Okra	0.5	7,531.5	0.01%
Cauliflower	0.3	15.3	1.64%
Pecans	0.0	11,175.0	0.00%
Wheat	0.0	2,200.0	0.00%
Papaya	0.0	2,000.0	0.00%
Grain	0.0	1,700.0	0.00%
Mango	0.0	1,500.0	0.00%
Beets	0.0	1,430.0	0.00%
Honeydews	0.0	1,045.0	0.00%
Sweet Corn	0.0	584.0	0.00%
Corn	0.0	560.0	0.00%
Sugar cane	0.0	500.0	0.00%
Chard	0.0	310.1	0.00%
Peaches	0.0	192.0	0.00%
Other <= 300 acres	9.5	1,912.0	0.50%
Total	**1,308.8**	**100,049.6**	**1.31%**

Organic growers engaged in the survey grow 24 different crops, predominantly grapefruit (475 acres), green beans (400 acres), oranges (120 acres), carrots (101.6 acres), and onions (66.5 acres). With the exception of sweet potatoes, which had 100% of their production organic, but only a very small area (2 acres), there were no crops with more than 10% of their total area grown as organic production.

4. What percentage of your total sales was sold to the following marketing channels?

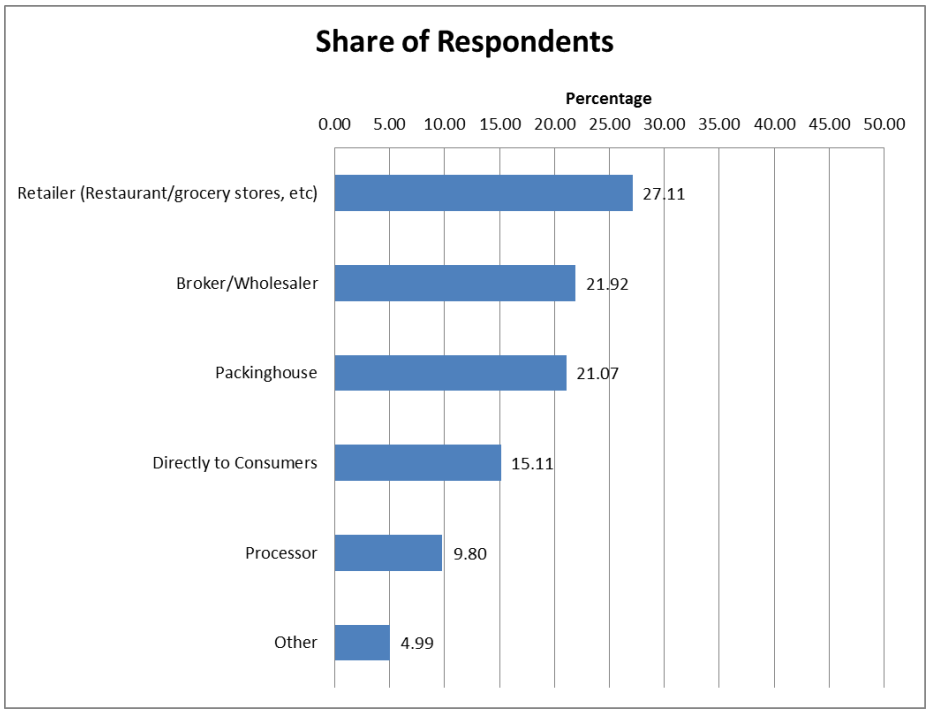

Figure 18. Percentage of total sales sold in each marketing channel (Share of respondents) (n=74).

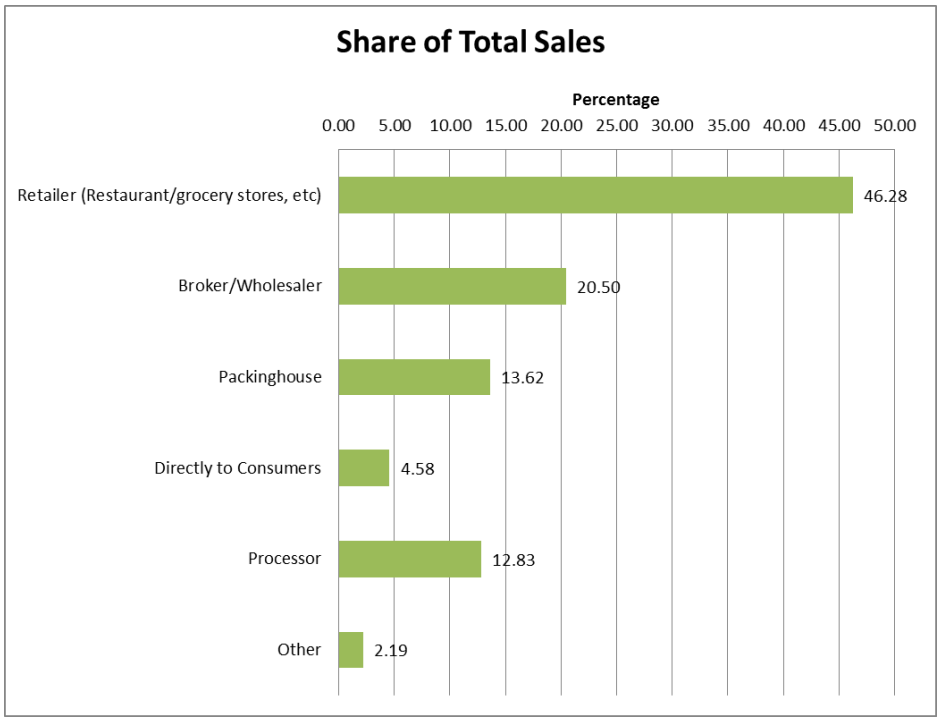

Figure 19. Percentage of total sales sold in each marketing channel (Share of total sales) (n=74).

In terms of number of marketing channels, the retailer category, which includes restaurants and grocery stores, was the predominant channel used by the respondents (27.11%), followed by broker/wholesaler channel (21.92%), packinghouse (21.07%), directly to Consumers (15.11 %), processor (9.8%) and other channels (4.99%) (Fig. 18).

In terms of percentage of total sales, the retailer channel was still the highest with 46.28%, followed by the broker/wholesaler channel which ranked second with 20.5%. Packinghouse and processors also accounted for a high percentage, 13.62% and 12.83%, respectively. Direct to consumers, and other channels represented 4.58% and 2.19% of sales, respectively (Fig. 19).

5. Using a scale from 1-5, (where 1 is not important and 5 is very important) how do you think the following factors would impact the Fruit and Vegetable Industry in Texas?

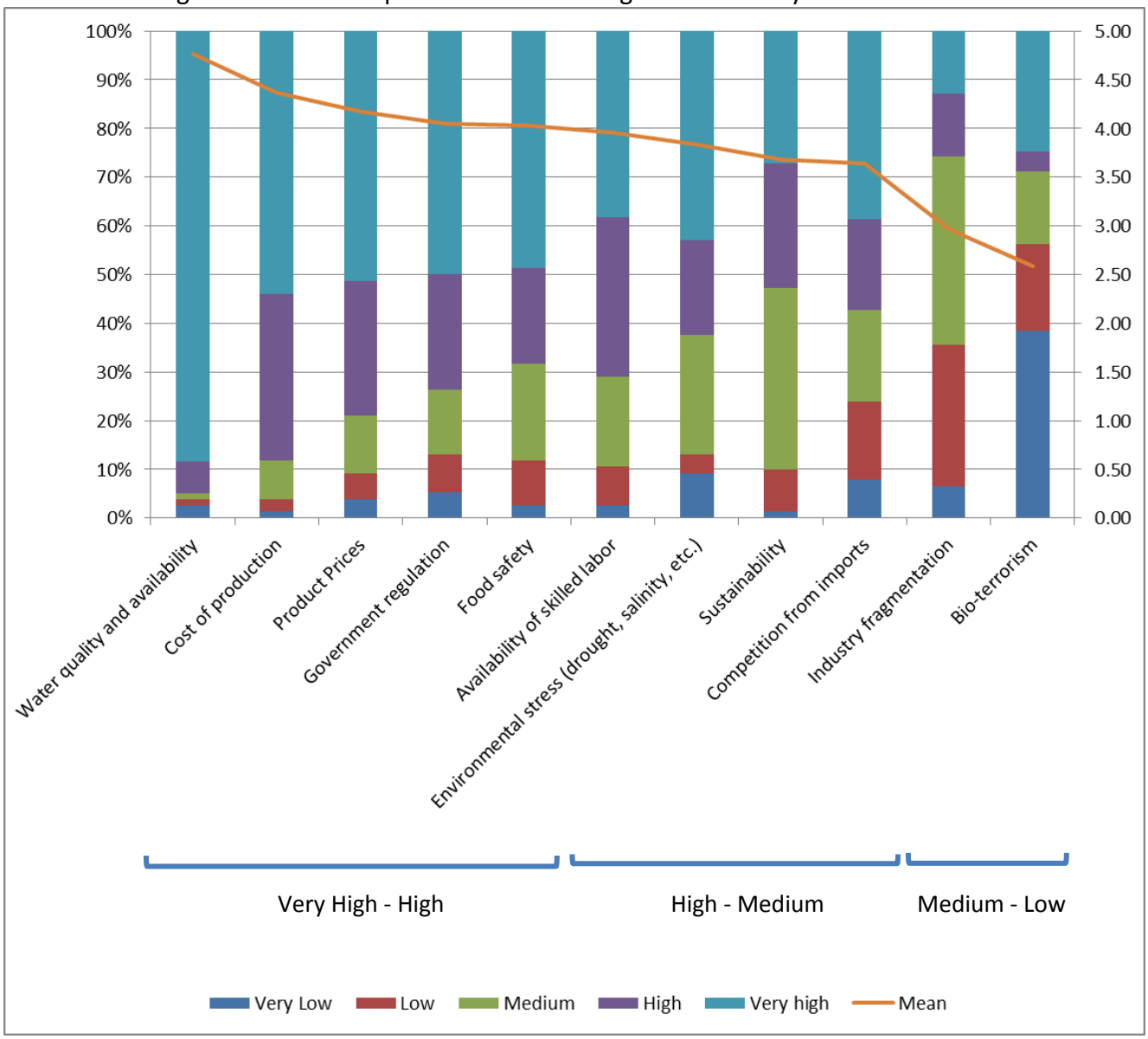

Figure 20. Factors that will impact the Fruit and Vegetable Industry in Texas (n range = 62-78)

Water quality and availability was by far the most important factor (4.77). Other important factors were: cost of production (4.37), product prices (4.17), government regulation (4.05), and food safety (4.03). Factors considered between high and medium were: availability of skilled workers (3.96), environmental stress (3.83), sustainability (3.69), and competition from Imports (3.64). Factors considered between medium and low were: industry fragmentation (2.97) and bio-terrorism (2.59). None of rankings for the eleven factors fall between low and very low category (Fig. 18). Factors in the "Other" category were: research expenditures, third party sellers and brokers, media, marketing, Industry concentration, pests, insecticides and pesticides, expansion of genetically modified seed, and availability of land.

6. Using a scale from 1-5, (where 1 is not important and 5 is very important) how would the following strengths contribute to the success of the Fruit and Vegetable Industry in Texas?

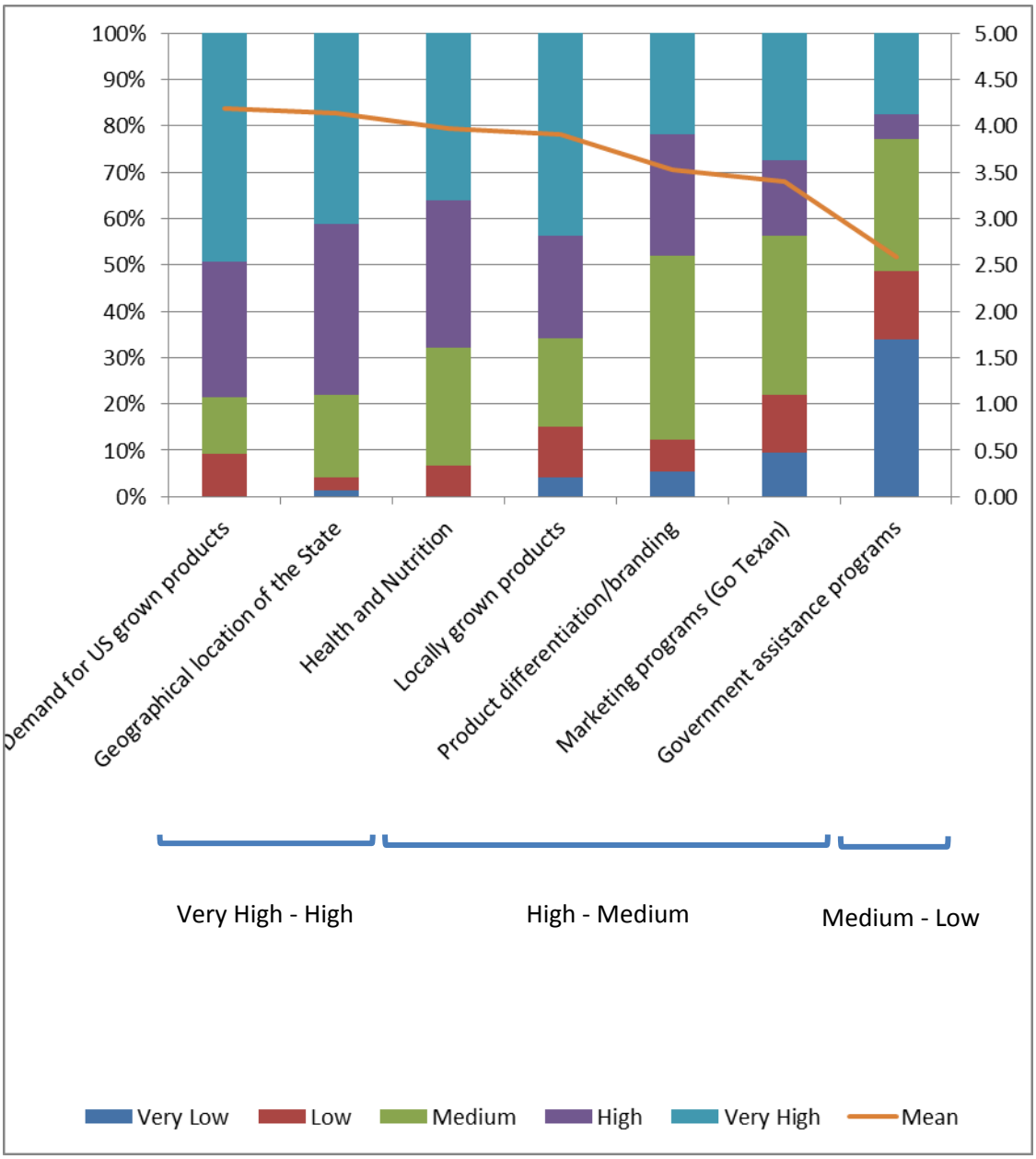

Figure 21. Strength factors that contribute to the success of the Fruit and Vegetable Industry in Texas (n= 73-75)

Strengths factors that contribute highly or very highly to the success of the fruit and vegetable industry were: demand for US grown products (4.19) and geographical location of the State (4.14). Strengths considered between high and medium categories were: health and nutrition (3.97), locally grown products (3.9), product differentiation (3.52), and marketing programs such us Go Texan (3.4). The only factor considered between medium and low for 33.8% of respondents was government assistance programs (2.58). There were no factors with a mean

between low to very low. Factors in the "Other" category were: the banking system, loyalty of Texas consumers, quality of the product and transportation to market.

7. Using a scale from 1-5, (where 1 is not important and 5 is very important) how would the following opportunities contribute to the success of the Fruit and Vegetable Industry in Texas?

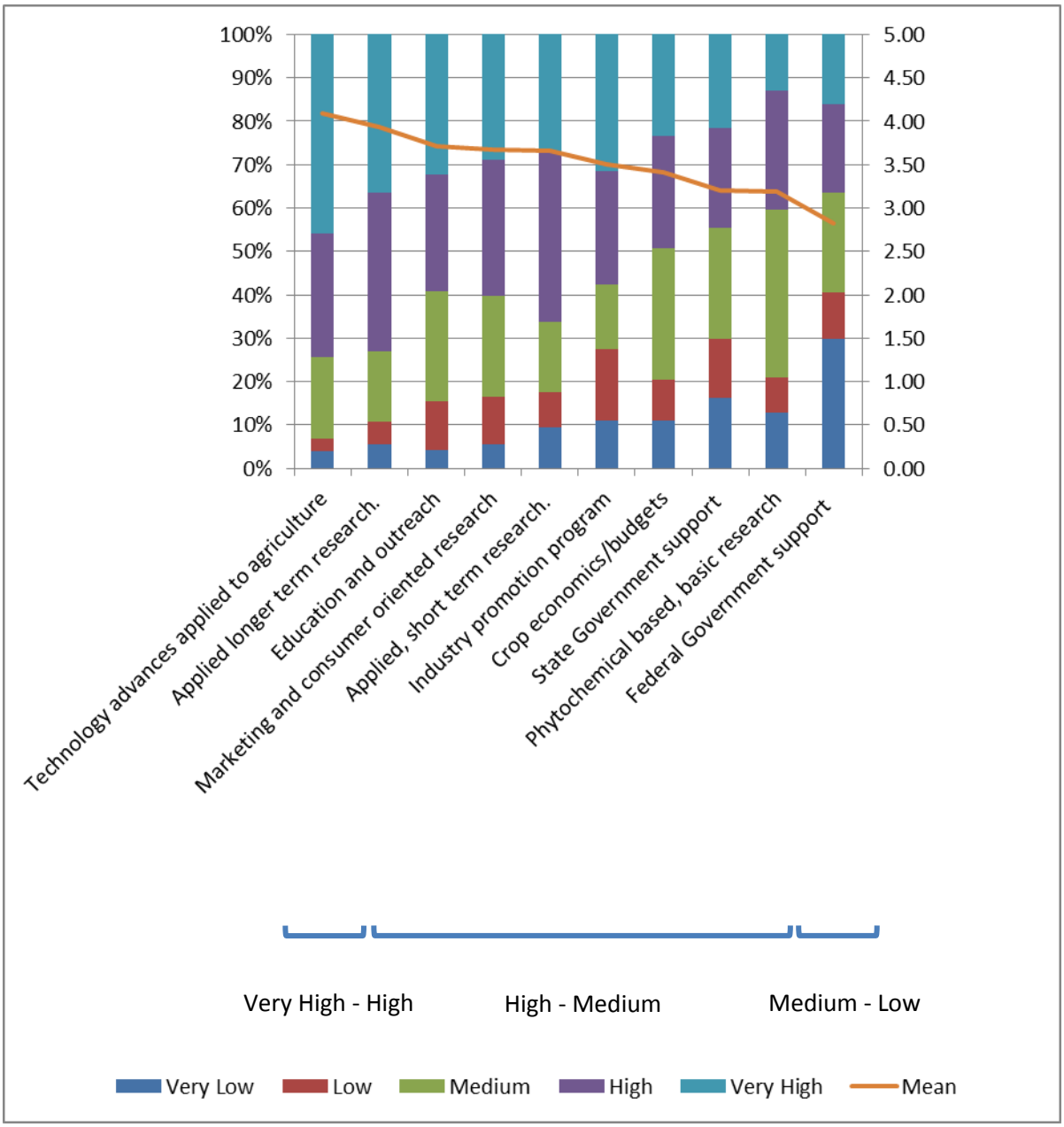

Figure 22. Opportunity factors that would contribute to the success of the Fruit and Vegetable Industry in Texas (n range = 73-74).

Technology advances applied to agriculture was the only factor rated very high as a possible contributor to the success of the fruit and vegetable industry (4.09). Factors in the high and medium categories included: applied longer term research (3.93), education and outreach (3.72), marketing and consumer oriented research (3.67), applied short term research (3.66), industry promotion program (3.51), crop economics/budgets (3.41), State government support (3.2), and phytochemical based basic research (3.19). The only factor ranked between medium and low was federal government support (2.82). There were no factors with a mean between low to very low. Factors in the "Other" category were: "green" laws, organic education, and ensured quality.

8. Using a scale from 1-5, (where 1 is not important and 5 is very important) how would the following pre-harvest research areas contribute to the success of the Fruit and Vegetable Industry in Texas?

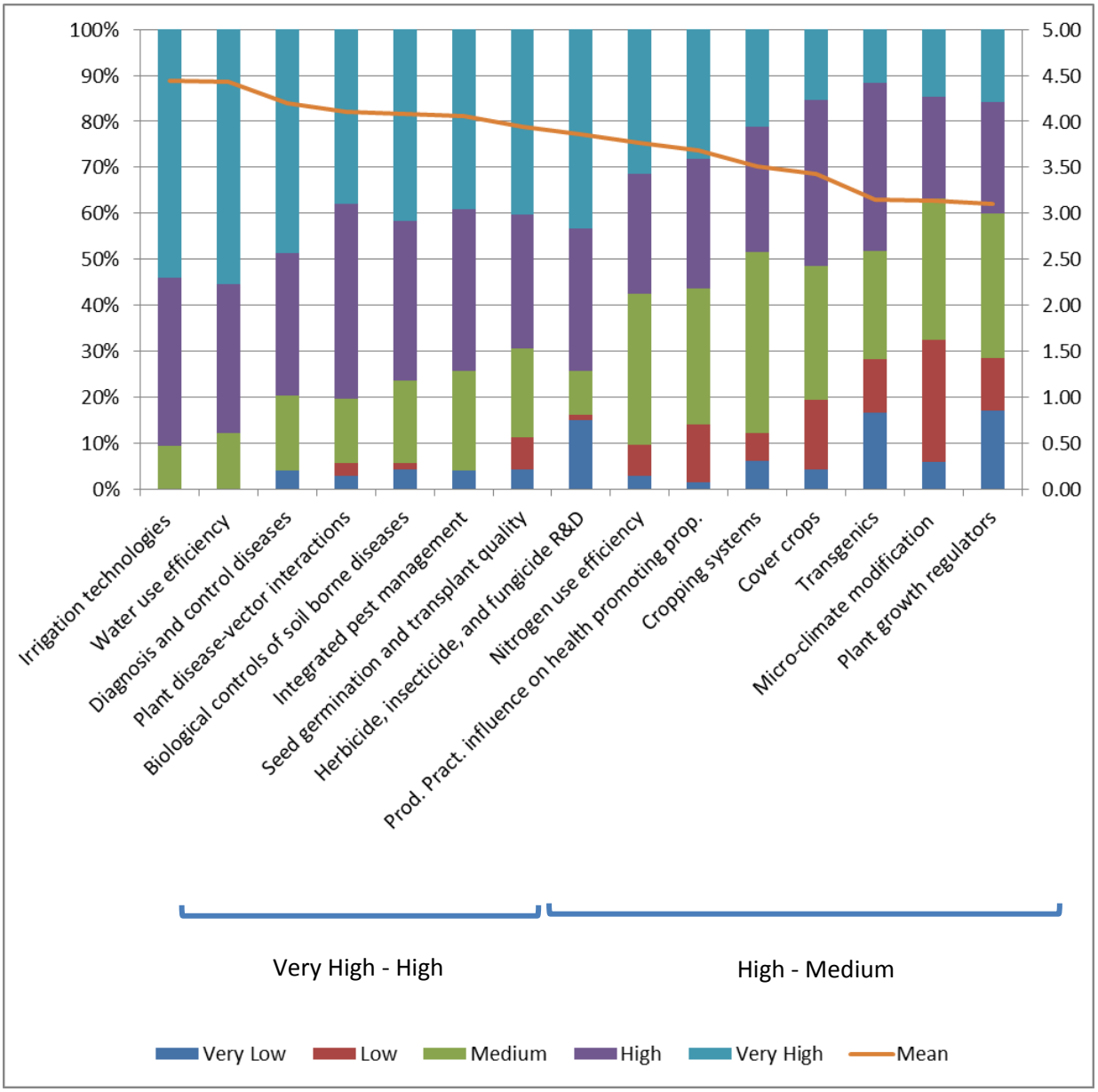

Figure 23. Pre-harvest research areas that contributes to the success of the Fruit and Vegetable Industry in Texas (n range = 60-74).

Most of the pre-harvest research areas were ranked between very high and high (Fig. 23). The highest two ranked categories were irrigation technologies (4.45) and water use efficiency (4.43). These two areas ranked very high by more than 50% of the respondents (54.05% and 55.41%, respectively). Other categories that ranked high were: diagnosis and control diseases (4.2), plant disease-vector interactions (4.1), biological control of soil borne diseases (4.08), and

integrated pest management (4.05). The medium ranked areas were: transgenic, micro-climate modification and plant growth regulators.

The "Other" category included: organic methods of pest and disease control, developing and promoting organic practices, crop rotations, soil balance nutrition, soil applied and foliar applied fertilization.

9. Using a scale from 1-5, (where 1 is not important and 5 is very important) how would the following post-harvest research areas contribute to the success of the Fruit and Vegetable Industry in Texas?

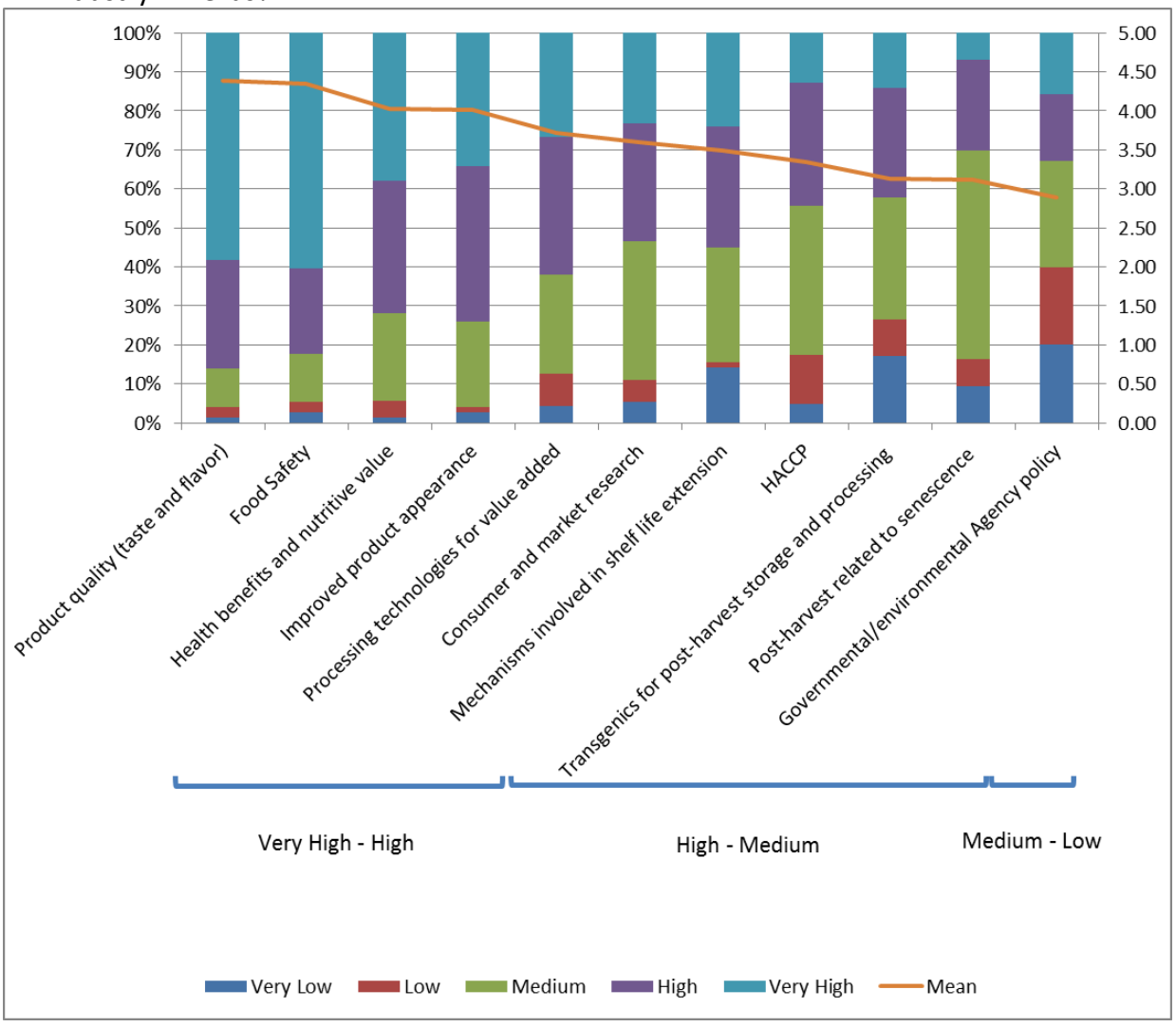

Figure 24. Post-harvest research areas that will contribute to the success of the Fruit and Vegetable Industry in Texas (n range = 63-73).

Four post-harvest research areas that ranked between high and very high were product quality (taste and flavor) (4.39), food safety (4.34), health benefits and nutritive value (4.03), and improved product appearance (4.01) (Fig. 24). Post-harvest research areas that ranked between

medium and high included processing technologies for value added (3.72), consumer and market research (3.60), mechanisms involved in shelf life expansion (3.49), hazard analysis and critical control points (3.35), transgenic for post-harvest storage and processing (3.13), and post-harvest related to senescence (3.12). Governmental/environmental agency policy (2.89) was the only area ranked between medium and low.

10. Are you familiar with Texas AgriLife Research or Texas AgriLife Extension?

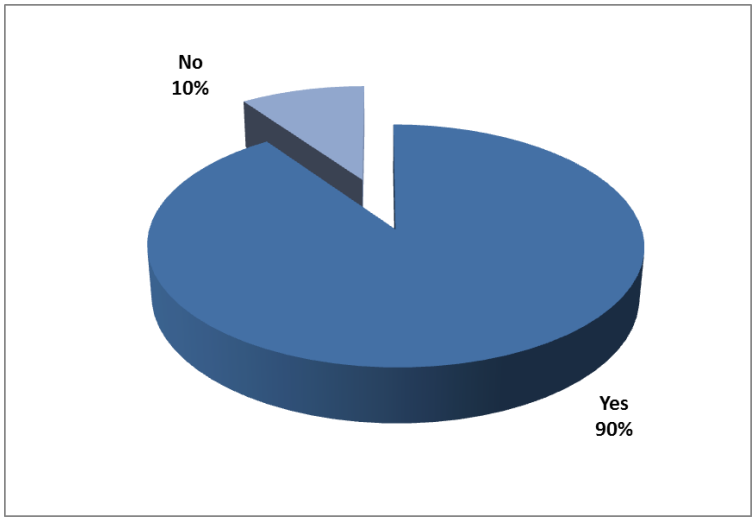

Figure 25. Familiar with Texas AgriLife Research or Extension (n=72).

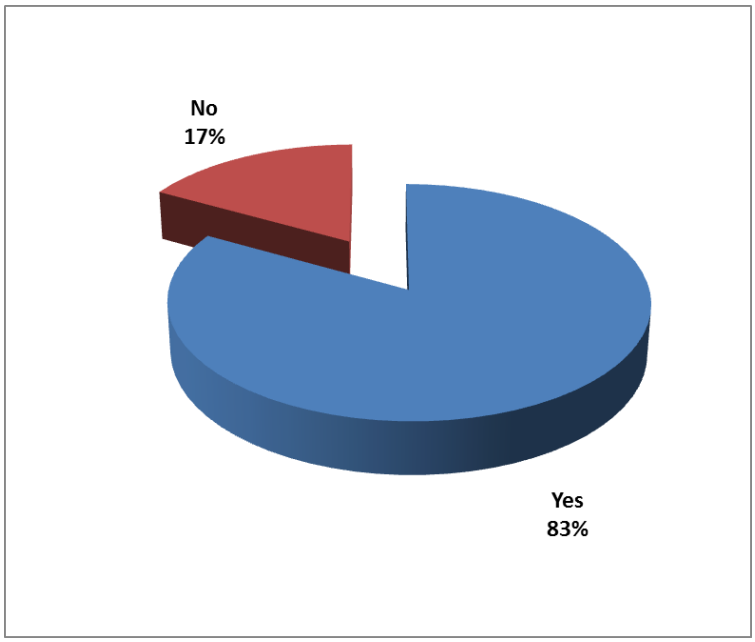

Figure 26. Respondents familiar with Texas A&M AgriLife that seek for help and support at Texas A&M AgriLife (n=65).

Overall, 90 % of respondents (n=72) are familiar with either Texas AgriLife Research or Texas AgriLife Extension, while only 10% were not familiar with either agency (Fig. 25). Moreover, from the respondents that were familiar with Texas A&M AgriLife Research or Extension, 83% seek help and support from Texas A&M AgriLife (Fig. 26).

11. When you need technical assistance, who do you normally seek for help and support?

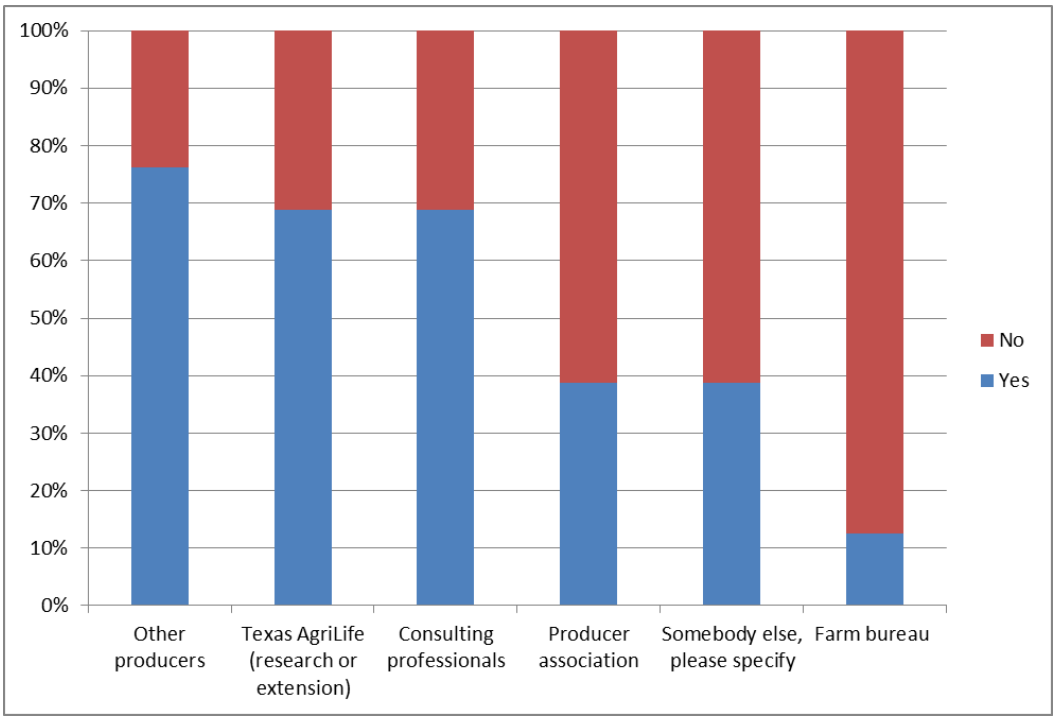

Figure 27. Technical assistance sources for help and support (n=80).

Other producers are the most important source of technical assistance for 76% respondents. Texas A&M AgriLife and consulting professionals were tied second with 69%. Producer associations and "somebody else" were chosen for less than half of the respondents (39%). The least chosen category for technical assistance was farm bureau (13%).

The "somebody else" category was specified as supplier company representatives (such as seed and chemical companies salesman) (33.3%), other Texas A&M departments (22.2%), family and relatives (11.1%), Attra (7.4%), bibliography from books and Internet (7.4%), county agent (3.7%), customers (3.7%), other Institutions (3.7%), out of area peers (3.7%), and Texas Tech University (3.7%).

12. How would you rate the following aspects of Texas AgriLife Research and Extension Programs for the Produce Industry?

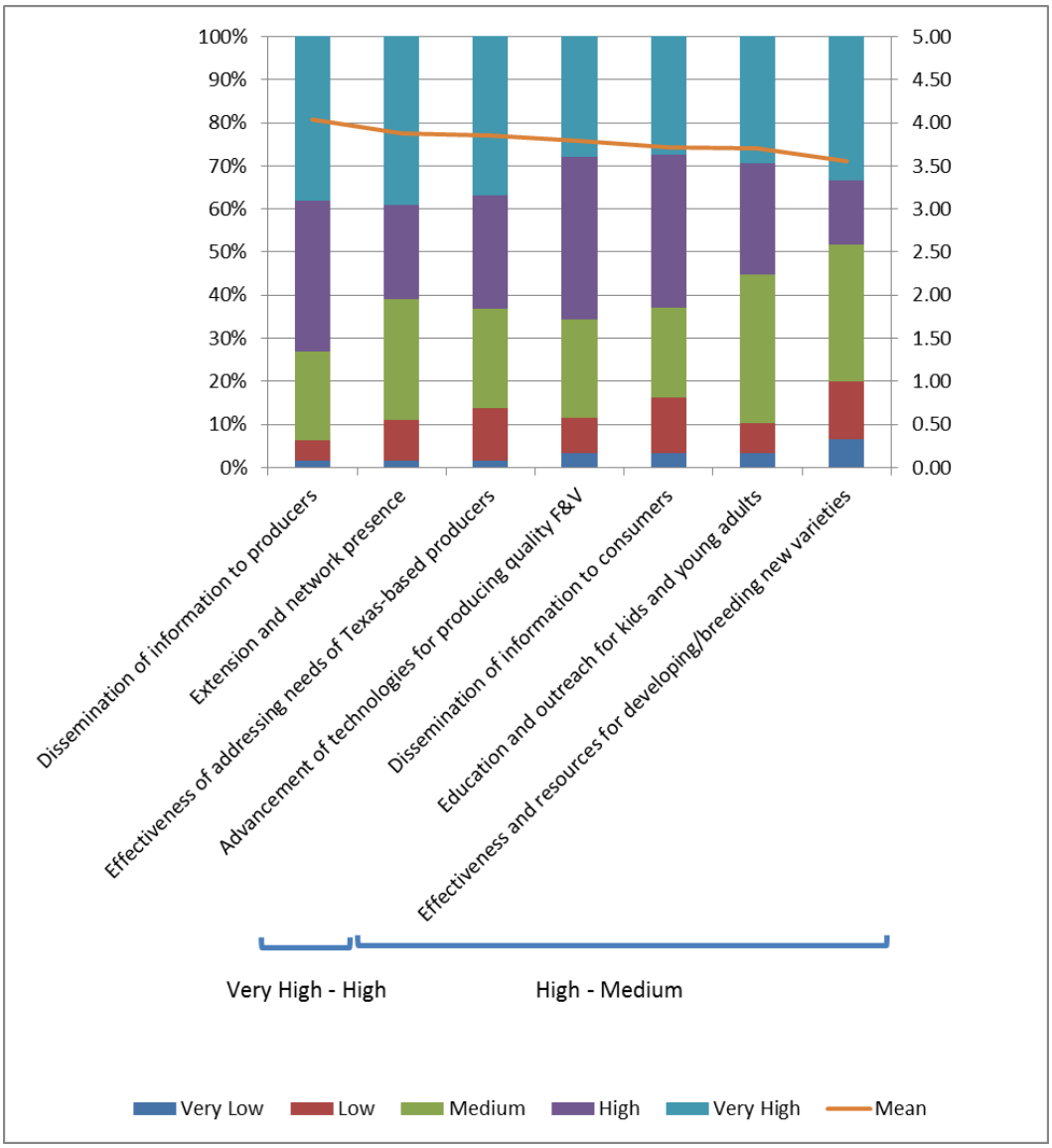

Figure 28. Rate of Texas AgriLife Research and Extension Programs for the Produce Industry (n range = 58-65).

Dissemination of information to consumers by Texas A&M AgriLife Research and Extension received the highest average rating by the respondents (4.03) (Fig. 28). The following activities were rated between medium and high: extension and network presence (3.88), effectiveness of addressing needs of Texas-based producers (3.85), advancement of technologies for producing quality fruits and vegetables (3.79), dissemination of information to consumers (3.71), education and outreach for kids and young adults (3.71), and effectiveness and resources for developing/breeding new varieties (3.55).

13. In your view, which are the top 3 crops that you believe need additional breeding to create improved varieties for Texas producers?

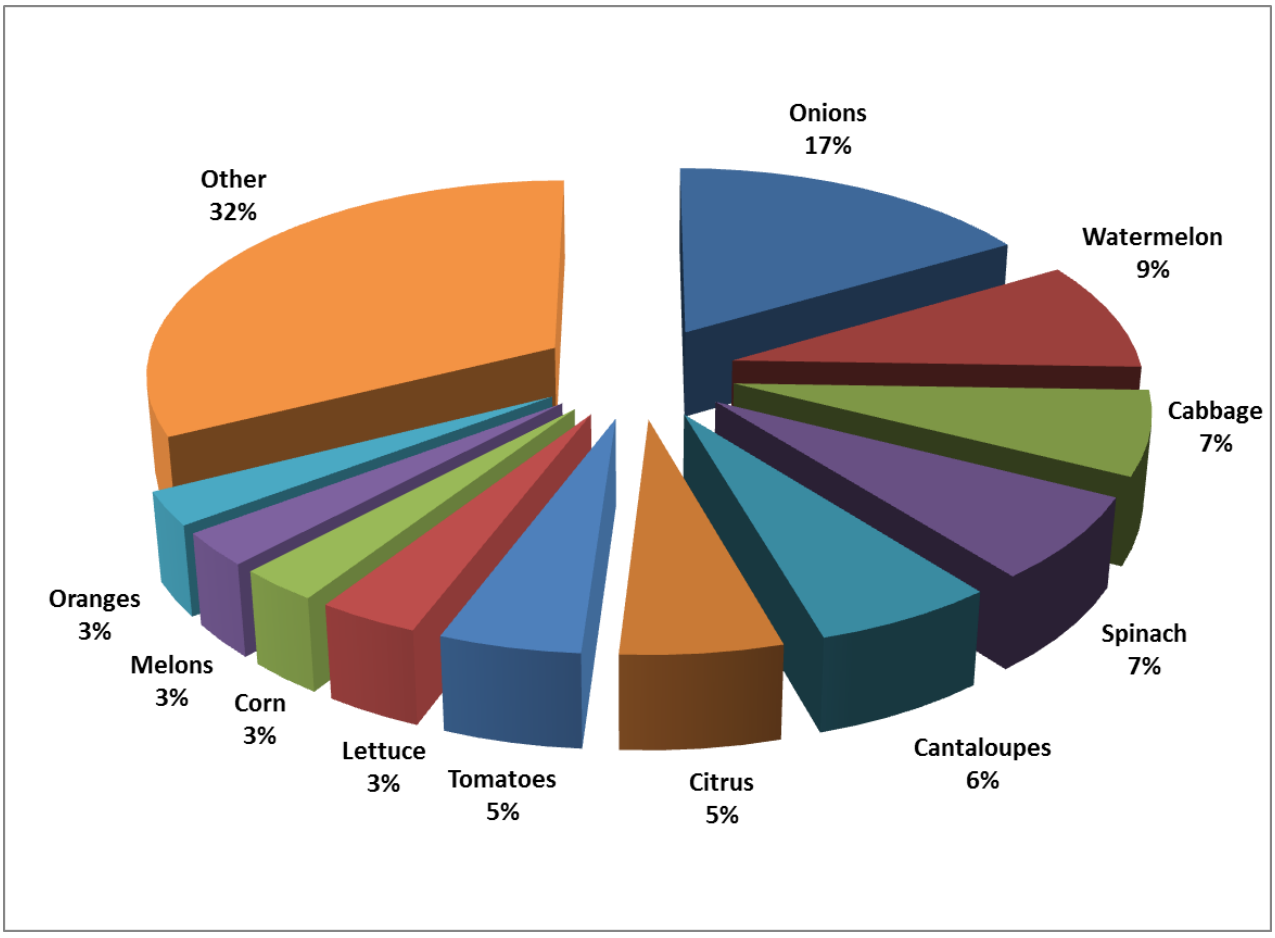

Figure 29. Top crops that need additional breeding to create improved varieties for Texas producers (n=59).

The predominant crop chosen by the respondents that need additional breeding to create improved varieties for Texas producers was onion (17%), followed by watermelon (9%), cabbage (7%), spinach (7%), cantaloupes (6%), citrus (5%), tomatoes (5%), lettuce (3%), corn (3%), melons (3%), oranges (3%), and other crops (32%) (Fig. 29).

About 52 percent of the crops selected were from respondents who are producers of that particular crop. But most importantly, 48 percent of the respondents believe that new crops other than the ones they are producing need additional breeding in order to create improved varieties for Texas producers.

14. Which programs/areas in Fruits and Vegetables do you think should be supported by growers and industry?

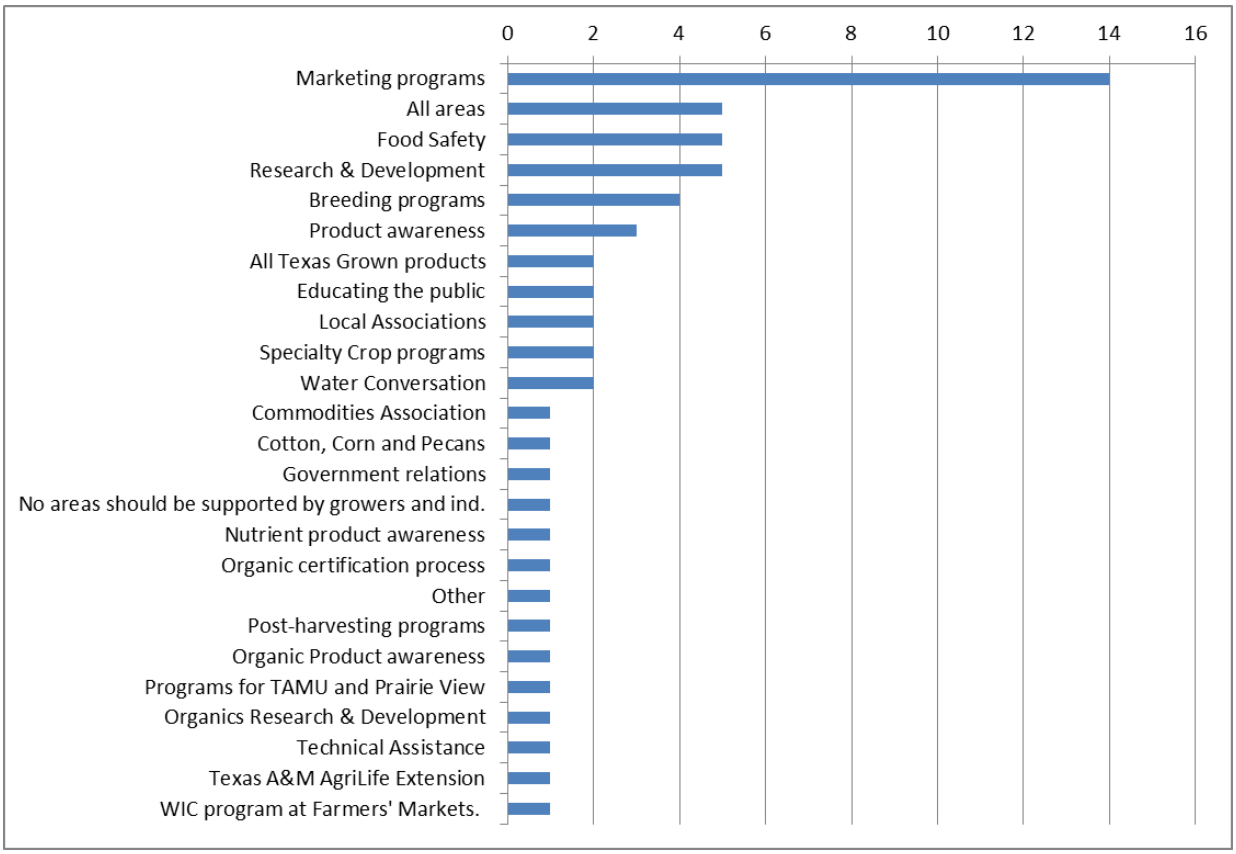

Figure 30. Programs/areas that should be supported by growers and industry (n=60).

From a total of 60 responses, 14 respondents believe that marketing programs should be top priority to be supported by growers and industry. The category for "all areas", food safety, and research and development were chosen five times, followed by breeding programs which was chosen four times. Other programs that received lower rankings were: product awareness (3), all Texas grown products (2), educating the public (2), local associations (1), specialty crop programs (2), water conservation (2), commodity associations (1), cotton, corn and pecans (1), government relations (1), no areas should be supported by growers and industry (1), nutrient product awareness (1), organic certification progress (1), other (1), port-harvesting programs (1), organic product awareness (1), programs for Texas A&M University and Prairie View (1), organics research and development (1), technical assistance (1), Texas A&M AgriLife Extension (1), WIC program at farmers' markets (1) (Fig. 30).

15. How many years have your firm been in business?

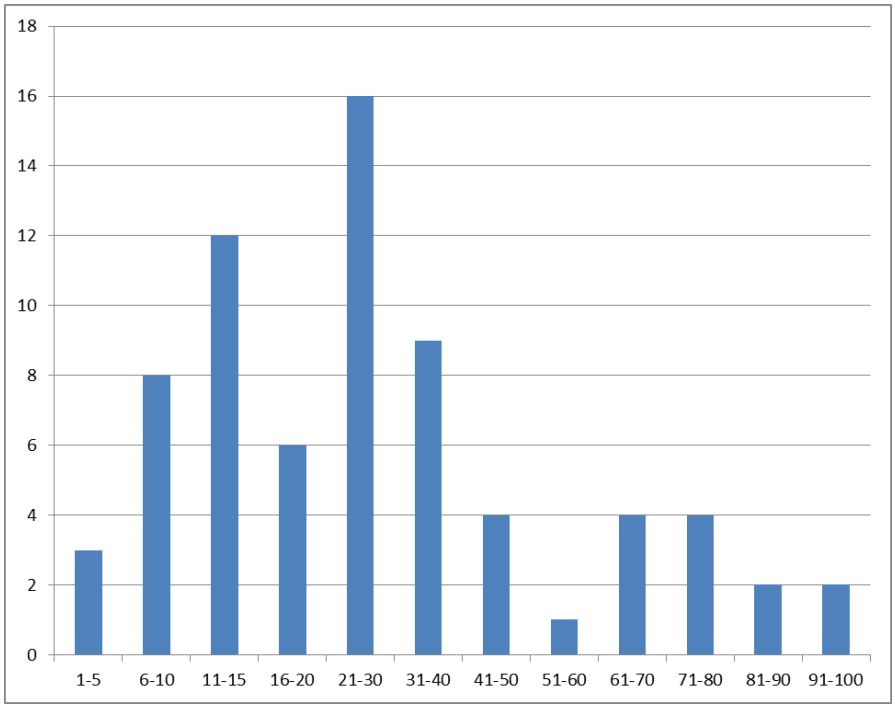

Figure 31. Year of the firm been in business (n=71).

The average number of years firms have been in business was 31.6 years. The distribution of years in operation indicates that the majority of respondents were in business between 21-30 years, following by 6 to 15 years (Fig. 31).

16. What is your age?

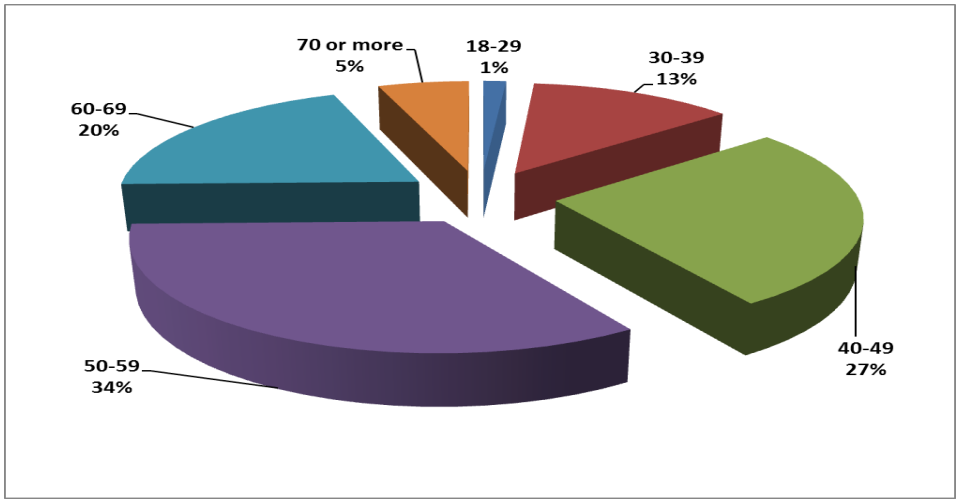

Figure 32. Percentage of the number of respondents in each Age category (n=71).

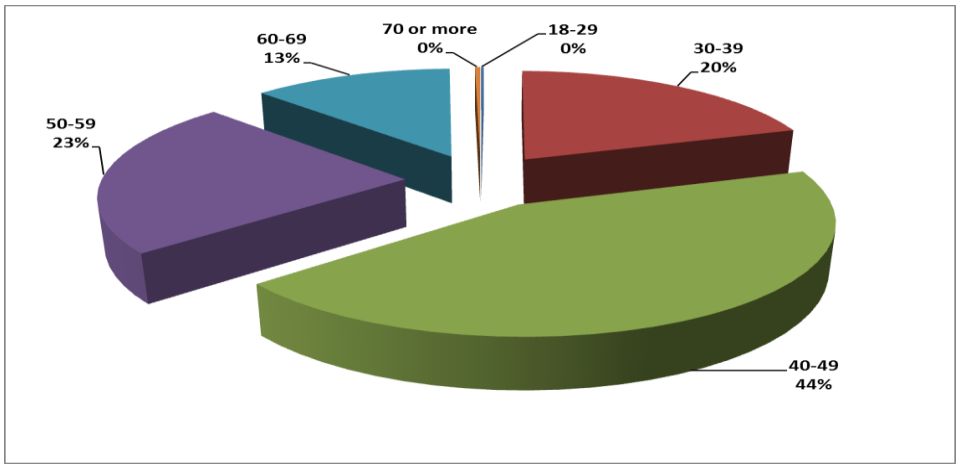

Figure 33. Percentage of Acres grown by each Age category (n=71)

The average age of the respondents was 51.2 years old, slightly less than the Texas average age farmer of 58.9 (2007 Census of Agriculture – State Data). Most respondents were between 50-59 years old (34%), followed by 40-49 (27%), 60-69 (20%), 30-39 (13%), 70 or more (5%), and 18-29 (1%) (Fig. 32).

The percentage of acres grown by respondents in each age category differs considerably with younger growers (30-49 years) dominating the area of production with 64% as compared to older growers (50-69 years) who accounted for 36% of the total area (Fig. 33.)

17. What is your gender?

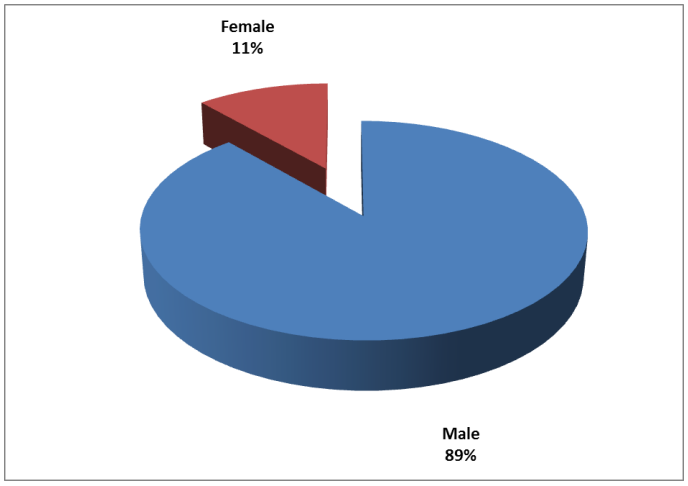

Figure 34. Gender (n=70).

Growers that responded the external survey were predominantly male (89%) while female growers represented 11% (Fig. 34). These numbers are fairly close to the numbers reported by the 2007 Census of Agriculture for the State of Texas with 14 percent females and 86 percent males.

18. What was the value of total gross sales for your operation last year?

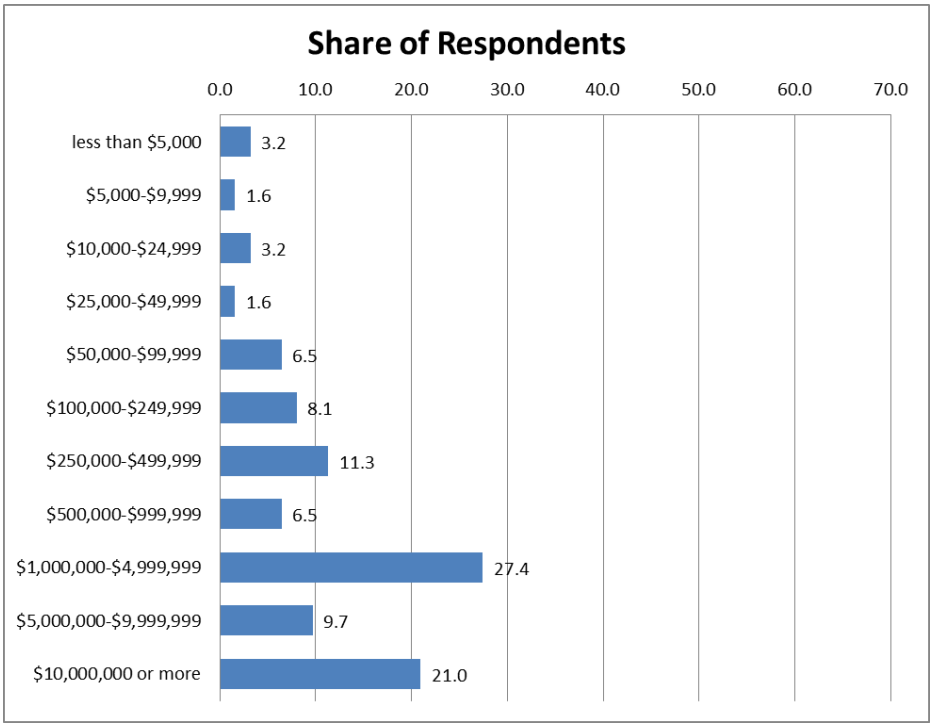

Figure 35. Total Gross Sales (Share of respondents) (n=62).

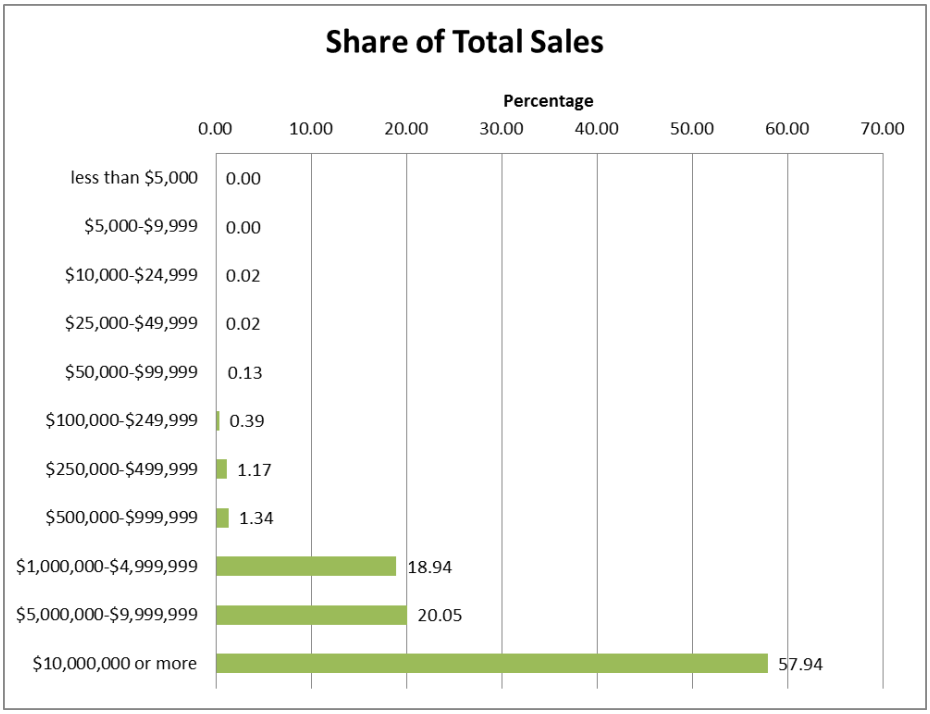

Figure 36. Total Gross Sales (Share of total sales) (n=62)

The average gross sales value of the firms who responded to the survey was $3,619,112, with a minimum value of less than $5,000 and a maximum value of more than $10,000,000. Most operations had gross sales between $1,000,000-$4,999,999 (27.4%), followed by 10,000,000 or more (21%), $250,000-$499,999 (11.3%), $5,000,000-$9,999,999 (9.7%), $100,000-$249,999 (8.1%), $50,000-$99.999 (6.5%), $500,000-$999,999 (6.5%), less than $5,000 (3.2%), $10,000-$24,999 (3.2%), $5,000-$9,999 (1.6%), and $25,000-$49,999 (1.6%) (Fig. 35).

Percentage gross sales value per share of total sales results differ from the previous ratios. Gross sales over $10,000,000 or more represents 57.94 % of the data, followed by gross sales between $5,000,000-$9,999,999 (20.06%) and $1,000,000-$4,999,999 (18.94%). The rest of the gross sales categories resulted in low percentages as shown in Fig. 21. Similar trends were found in the 2007 Census of Agriculture for the State of Texas (Fig. 36). However, the survey sample data was skewed toward larger size farms when compared to the census data.

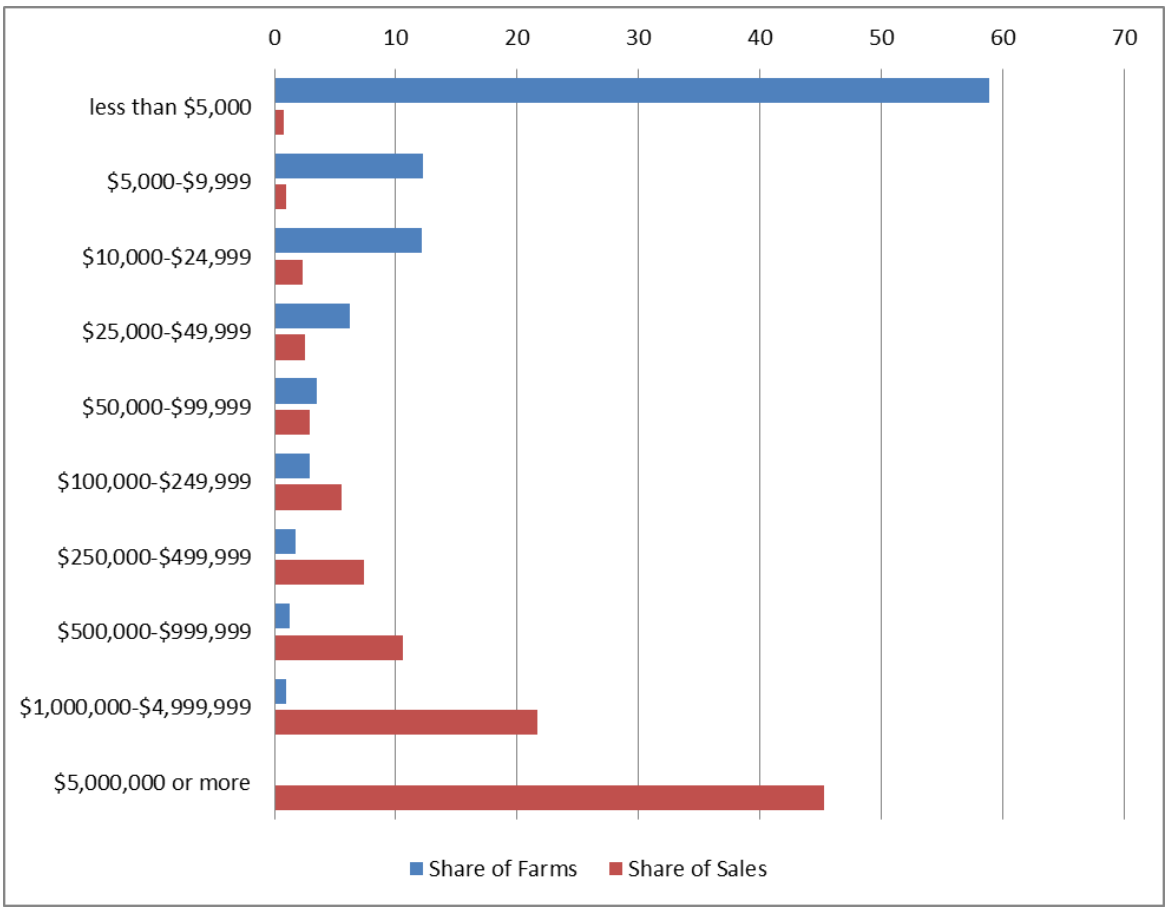

Figure 37. 2007 Census of Agriculture – State Data. Percentage of gross sales per share of farms and per share of sales.

Appendix A: Blank survey (external))

Fruit and Vegetable Industry Survey

Texas AgriLife in conjunction with Texas Vegetable and Fruit Growers is conducting this survey to assess the current state of the fruit and vegetable industry in the State of Texas and to help us better serve the needs of the industry. Thank you for taking a few minutes to participate in this survey. The survey is designed to provide an assessment of the strengths, gaps, opportunities and threats of the fruit and vegetable industry. **Your participation is voluntary and strictly confidential.**

For more information contact:

Contact Name
Address
Tel
email

1. How many acres of the following crops does your operation grow?

Crop	*Acres Grown*
Bell Peppers	
Chili Peppers	
Tomatoes	
Sweet Corn	
Cantaloupes	
Watermelons	
Honeydews	
Cucumbers	
Potatoes	
Sweet Potatoes	
Onions	
Spinach	
Cabbage	
Cauliflower	
Broccoli	
Kale	
Collards	
Mustard	
Carrots	
Okra	
Squash	
Lettuce	
Herbs and Spices	
Grapefruit	
Oranges	
Peaches	
Pecans	
Other:_____	
Other:_____	
Other:_____	
Total	

2. Does your operation include commercial organic production?
a. Yes _____
b. No _____ (Skip to question 4)

3. How many acres of the following crops were grown organically?

Crop	*Acres Grown*
Bell Peppers	
Chili Peppers	
Tomatoes	
Sweet Corn	
Cantaloupes	
Watermelons	
Honeydews	
Cucumbers	
Potatoes	
Sweet Potatoes	
Onions	
Spinach	
Cabbage	
Cauliflower	
Broccoli	
Kale	
Collards	
Mustard	
Carrots	
Okra	
Squash	
Lettuce	
Herbs and Spices	
Grapefruit	
Oranges	
Peaches	
Pecans	
Other:_____	
Other:_____	
Other:_____	
Total	

4. What percentage of your total sales was sold to the following marketing channels?

a. Directly to consumer (Farmer's market, CSA, etc.)	_____%
b. Packinghouse	_____%
c. Processor	_____%
d. Broker/Wholesaler	_____%
e. Retailer (Restaurant/grocery stores, etc.)	_____%
f. Other	_____%
Total	**100%**

5. Using a scale from 1-5, (where 1 is not important and 5 is very important) how do you think the following factors would impact the Fruit and Vegetable Industry in Texas?

Item	Scale				
	Very Low (1)	Low (2)	Medium (3)	High (4)	Very high (5)
Water quality and availability	❍	❍	❍	❍	❍
Environmental stress (drought, salinity, etc.)	❍	❍	❍	❍	❍
Sustainability	❍	❍	❍	❍	❍
Competition from imports	❍	❍	❍	❍	❍
Cost of production	❍	❍	❍	❍	❍
Product prices	❍	❍	❍	❍	❍
Availability of skilled labor	❍	❍	❍	❍	❍
Food safety	❍	❍	❍	❍	❍
Bio-terrorism	❍	❍	❍	❍	❍
Government regulation	❍	❍	❍	❍	❍
Industry fragmentation	❍	❍	❍	❍	❍

Other (Please specify): _____

6. Using a scale from 1-5, (where 1 is not important and 5 is very important) how would the following strengths contribute to the success of the Fruit and Vegetable Industry in Texas?

Item	Scale				
	Very Low (1)	Low (2)	Medium (3)	High (4)	Very high (5)
Geographical location of the State	❍	❍	❍	❍	❍
Demand for US grown products	❍	❍	❍	❍	❍
Locally grown products	❍	❍	❍	❍	❍
Marketing programs (Go Texan)	❍	❍	❍	❍	❍
Product differentiation/branding	❍	❍	❍	❍	❍
Government assistance programs	❍	❍	❍	❍	❍
Health and nutrition	❍	❍	❍	❍	❍

Other (Please specify): _____

7. Using a scale from 1-5, (where 1 is not important and 5 is very important) how would the following opportunities contribute to the success of the Fruit and Vegetable Industry in Texas?

Item	Scale				
	Very Low (1)	Low (2)	Medium (3)	High (4)	Very high (5)
Government support	❍	❍	❍	❍	❍
Industry promotion program	❍	❍	❍	❍	❍
Applied, short term research. Ex: Variety Testing	❍	❍	❍	❍	❍
Applied longer term research. Ex: Marker-assisted breeding and development of new varieties	❍	❍	❍	❍	❍
Phytochemical based, basic research	❍	❍	❍	❍	❍
Education and outreach	❍	❍	❍	❍	❍
Marketing and consumer oriented research	❍	❍	❍	❍	❍
Technology advances applied to agriculture	❍	❍	❍	❍	❍
Crop economics/budgets	❍	❍	❍	❍	❍

Other (Please specify): _____

8. Using a scale from 1-5, (where 1 is not important and 5 is very important) how would the following *pre-harvest* research areas contribute to the success of the Fruit and Vegetable Industry in Texas?

Item	Scale				
	Very Low (1)	Low (2)	Medium (3)	High (4)	Very high (5)
Micro-climate modification (much films, row covers, etc.)	❍	❍	❍	❍	❍
Integrated pest management	❍	❍	❍	❍	❍
Plant growth regulators	❍	❍	❍	❍	❍
Cropping systems	❍	❍	❍	❍	❍
Water use efficiency (e.g. drought tolerance)	❍	❍	❍	❍	❍
Irrigation technologies (e.g. drip, moisture and canopy sensors, etc.)	❍	❍	❍	❍	❍
Transgenics	❍	❍	❍	❍	❍
Seed germination and transplant quality	❍	❍	❍	❍	❍
Cover crops	❍	❍	❍	❍	❍
Biological controls of soil borne diseases	❍	❍	❍	❍	❍
Diagnosis and control diseases	❍	❍	❍	❍	❍
Plant disease-vector interactions	❍	❍	❍	❍	❍
Herbicide, insecticide, and fungicide R&D	❍	❍	❍	❍	❍
Production practices influence on health promoting properties	❍	❍	❍	❍	❍
Nitrogen use efficiency	❍	❍	❍	❍	❍
Other (Please specify): _____					

9. Using a scale from 1-5, (where 1 is not important and 5 is very important) how would the following *post-harvest* research areas contribute to the success of the Fruit and Vegetable Industry in Texas?

Item	Scale				
	Very Low (1)	Low (2)	Medium (3)	High (4)	Very high (5)
HACCP (Hazard Analysis and Critical Control Points)	❍	❍	❍	❍	❍
Post-harvest related to senescence	❍	❍	❍	❍	❍
Consumer and market research	❍	❍	❍	❍	❍
Product quality (taste and flavor)	❍	❍	❍	❍	❍
Food Safety	❍	❍	❍	❍	❍
Improved product appearance	❍	❍	❍	❍	❍
Governmental/environmental Agency policy	❍	❍	❍	❍	❍
Health benefits and nutritive value	❍	❍	❍	❍	❍
Processing technologies for value added	❍	❍	❍	❍	❍
Mechanisms involved in shelf life extension	❍	❍	❍	❍	❍
Other (Please specify): _____					

10. Are you familiar with Texas AgriLife Research or Texas AgriLife Extension?

a. Yes _____
b. No _____

11. When you need technical assistance, who do you normally seek for help and support? (Mark all that apply)

a. _____Texas AgriLife (research or extension)
b. _____Consulting professionals
c. _____Farm bureau
d. _____Other producers
e. _____Producer association
f. _____Somebody else, please specify:_____

12. How would you rate the following aspects of Texas AgriLife Research and Extension Programs for the Produce Industry?

Item	Scale				
	Very Low (1)	Low (2)	Medium (3)	High (4)	Very high (5)
Dissemination of information to consumers	❍	❍	❍	❍	❍
Dissemination of information to producers	❍	❍	❍	❍	❍
Extension and network presence	❍	❍	❍	❍	❍
Effectiveness of addressing needs of Texas-based producers	❍	❍	❍	❍	❍
Effectiveness and resources for developing/breeding new varieties	❍	❍	❍	❍	❍
Education and outreach for kids and young adults	❍	❍	❍	❍	❍
Advancement of technologies for producing quality F&V	❍	❍	❍	❍	❍
Other (Please specify): _____					

13. In your view, which are the top 3 crops that you believe need additional breeding to create improved varieties for Texas producers?

a. _____
b. _____
c. _____

14. Do you currently support financially any Texas AgriLife programs?
a. Yes _____
b. No _____

15. Do you plan to contribute financially for a research/outreach project in the next five years?
a. Yes _____
b. No _____

16. How many years has your firm been in business?

_____ Years

17. What is your age?
_____ 18-29
_____ 30-39
_____ 40-49
_____ 50-59

_____ 60-69
_____ 70 or more

18. What is your gender?
_____Male
_____Female

19. What was the value of total gross sales for your operation last year?

_____ Less than $5,000	_____ $50,000-$99,999	_____ $1,000,000-$4,999,999
_____ $5,000-$9,999	_____ $100,000-$249,999	_____ $5,000,000-$9,999,999
_____ $10,000-$24,999	_____ $250,000-$499,999	_____ $10,000,000 or more
_____$25,000-$49,999	_____ $500,000-$999,999	

Thank you for your response.